

2

Scientific style

If any man wish to write in a clear style, let him be first clear in his thoughts.

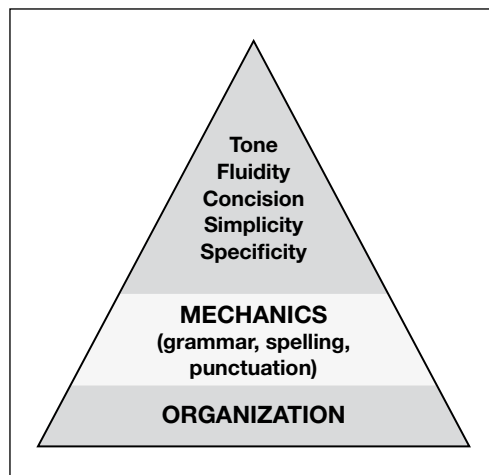
Johann Wolfgang von Goethe

2.1. Principles

Principles and rules are intended to provide a thinking man with a frame of reference.

Carl von Clausewitz

The main goal of scientific writing is to inform: a) to communicate your results and conclusions to others working in your field, b) to record what you have done, so others can check your work and evaluate your results and conclusions, and c) to educate those who are getting started in your field or working in related fields. This last point is important; it is not enough for other



The pyramid of scientific style

experts in your specific area of interest to understand your text. Well-written scientific texts present complex information in a way that enables relatively knowledgeable readers to understand it as easily as possible. Efficient organization and impeccable mechanics are fundamental to this task, but a series of other principles must also be applied to ensure clarity and comprehension.

The following exercise aims to get you thinking about scientific style. It can be quite challenging, so be sure to give yourself plenty of time. On the other hand, if you have severe difficulties with one of the sentences, do not hesitate to move on to the next one.

Exercise 5

Each of the following sentences violates at least one principle of scientific style (related to the text written *in bold italics*). Examine each sentence and use your imagination to decide how it could be improved. Then try to define the principle illustrated in each group of five sentences. If you find this second part of the task too challenging, you can look at the list of principles on page 15 and do it as a matching exercise.

I. _____

EXAMPLE: A ***number of patients*** had ***significant headaches***. *Twenty patients had headaches ≥ 7 on the visual analogue scale.*

- 1) We ***exposed 20 animals*** to ***high levels of*** chloromethane.
- 2) Cardiac output was ***drastically compromised***.
- 3) ***With*** the administration of amiodarone, the frequency and length of runs of tachycardia decreased.
- 4) An ***elderly patient*** presented with ***abnormal heart sounds***.

II. _____

EXAMPLE: The ambulance team must ***have the capability*** to provide basic emergency care interventions. *The ambulance team must be able...*

- 1) ***The vast majority of*** patients had ***suffered*** traffic accidents.
- 2) The incidence of type II diabetes is increasing in ***the pediatric population***.
- 3) We studied ***16 male and 14 female patients*** with congestive heart failure.
- 4) ***Monitorization of the patients' vital signs*** was ***carried out by the nursing team***.

III. _____

EXAMPLE: A protocol for weaning patients from mechanical ventilation is ***absolutely essential***. *A protocol for weaning patients from mechanical ventilation is essential.*

- 1) CT ***was performed and*** revealed ***the presence of*** massive subarachnoid hemorrhage.
- 2) Bilirubin causes the urine to become ***a dark brown color***.
- 3) The purpose of a Rapid Response Team is to support ***the*** hospital personnel ***outside of*** the ICU and ***the*** ED.
- 4) ***Two distinct*** studies are ***currently underway*** to explore this phenomenon.

IV. _____

EXAMPLE: Meningiomas are more common in women and are multiple in up to 40% of cases. ***This*** is more usual in patients with neurofibromatosis 2. *Meningiomas are more common in women and are multiple in up to 40% of cases. Multiple meningiomas are more usual in patients with neurofibromatosis 2.*

- 1) ***Cognitive impairment*** is common in ICU patients. ***These neuropsychological deficits*** can persist long after discharge. ***Neurocognitive deficits*** can affect patient's ***ability to perform tasks of daily living***. This decreased quality of life...
- 2) At our ***center***, ***haemopexin*** levels are often ***utilised*** to diagnose ***hemolytic anaemia***.
- 3) When ***heart rate increases***, ***there is usually an increase*** cardiac output, too.
- 4) She spoke at the ***critical patient rights protection regulations consensus conference***.

V.

EXAMPLE: *It is well known that* trauma patients can develop post-traumatic stress syndrome. *Trauma patients can develop post-traumatic stress syndrome.*

- 1) These results *clearly demonstrate* an *unambiguous improvement* over existing treatment options.
- 2) Our results *could suggest* that this treatment *might possibly have some* benefit in the treatment of a *select group* of patients.
- 3) When a *urologist* interprets the PSA, *he* takes many factors into consideration.
- 4) A 20-year-old *male Gypsy* presented with a knife wound.

VI.

EXAMPLE: The *ionogram* showed renal dysfunction. *The serum electrolytes showed renal dysfunction.*

- 1) In *general medicine* you inject acts faster than medicine you swallow.
- 2) Nearly half of our patients had *cardiopathies*.
- 3) Abused *infants* often *corroborate* their caretakers' lies.
- 4) *Looking through the microscope, islands of trophoblastic cells* were surrounded by extensive necrosis.

Note that the principles in the following list are interrelated and can overlap.

Principles of Scientific Style

- a) Keep writing as simple as possible—avoid unnecessary complexity.
- b) Ensure that the ideas flow smoothly—eliminate obstacles to comprehension.
- c) Maintain the right attitude—be forthright and humble, show respect for others.
- d) Be concise—make every word count.
- e) Be specific—don't make readers guess important details.
- f) Be accurate—use the correct terms and mechanics (spelling, grammar, and punctuation).

Exercise 6

Identify the problem and suggest an approach to fixing it.

EXAMPLE: Our innovative approach revolutionizes the treatment of... *This is a problem of attitude (arrogance). Better to begin* Our approach improves the treatment of...

- 1) Fludrocortisone is absorbed rapidly from the GI tract with a peak plasma concentration within 1.5 hours.

- 2) Vasopressors are indicated following the initiation of cardiopulmonary resuscitation.

- 3) The trigeminal nerve is the largest of the cranial nerves. CN5 provides the tactile, proprioceptive, and nociceptive afference of the face and mouth. The fifth cranial nerve activates the muscles of mastication, the tensor tympani, tensor veli palatini, mylohyoid, and anterior belly of the digastric.

Continue

- 4) Anesthetists must complete a four-year residency program after medical school.

- 5) This is the first study to show beyond the shadow of doubt that...

- 6) A nurse will be responsible for taking your temperature and blood pressure. She should always inform you of her findings.

- 7) Multiple organ failure was associated with death in all cases.

- 8) We aimed to study the appearance of pseudoangiomatous stromal hyperplasia (PASH) on mammography (MG), computed tomography (CT), magnetic resonance imaging (MRI), and ultrasonography (US) and to detail the differential diagnosis with angiosarcoma (AS)... At MG and US, AS was impossible to distinguish from PASH.

- 9) Complete surgical resection of the lesion was done.

- 10) Her gallbladder was resected by a surgeon.

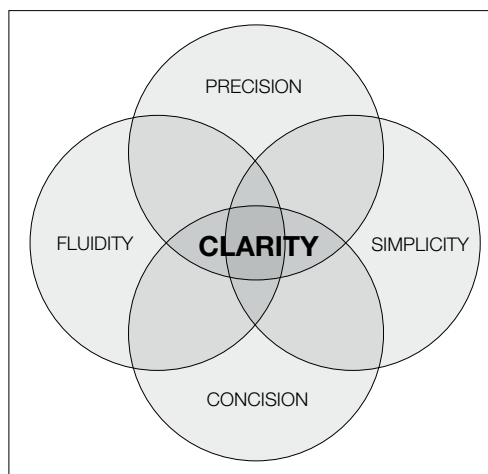
2.2. Clarity

In language, clarity is everything.

Confucious

The defining characteristic of good scientific writing is clarity. Clear writing reflects clear thinking.

The following diagram shows four basic aspects of scientific style that have an impact on clarity. Although we will deal with each aspect separately, bear in mind that they are interrelated and there is considerable overlap among them.



Major aspects related to clarity

Working to make your text more precise will help to ensure it flows smoothly. On the other hand, working to make your text flow smoothly can help you find ambiguities and thus make your text more precise. Similarly, working to make your text concise can help to eliminate unnecessary complexity. On the other hand, simplifying a text nearly always shortens it.

Each of the following sections in this book deals with one of these characteristics, presenting strategies and advice for tackling common problems and pitfalls that can prevent you from achieving that characteristic and thus from achieving your final goal of being clear.

Precision: Avoiding ambiguity

A writer should have the precision of a poet and the imagination of a scientist.

Vladimir Nabokov

An ambiguous message is a message that can be interpreted in more than one way. Fiction writers use ambiguity to their advantage; leaving a few details to the readers' imaginations can help make their stories seem more realistic. However, scientific communication has a very low tolerance for ambiguity. It is not enough for readers to be able to grasp the intended meaning. Readers should not have to consider multiple interpretations. The burden of clarity rests on the writer's shoulders. To make sure your message gets through, you need to say what you really mean and make sure that there are no other possible interpretations for what you write.

To this end, you must be careful about the words you use and the way you use them. Make sure your terminology is correct, specific, and consistent. Make sure your word order does not allow confusion. Make sure your spelling, grammar, and punctuation are impeccable. Figure 3 shows the major elements involved in precision.

All these tasks are easier when you keep things simple (see *Simplicity: Avoiding unnecessary complexity*).

Choosing the right words

It is crucial to use the correct words and to use words correctly. Always consult a dictionary, especially if you have consulted a thesaurus. Be aware that few words mean exactly the same thing; even when the denotation is the same, the connotations can be quite different. Likewise, try to use the right register: scientific writing is relatively formal.

Vague words are open to interpretation; specific words help make sure your meaning is understood. It can be difficult to detect vague words, because we always understand the meaning of

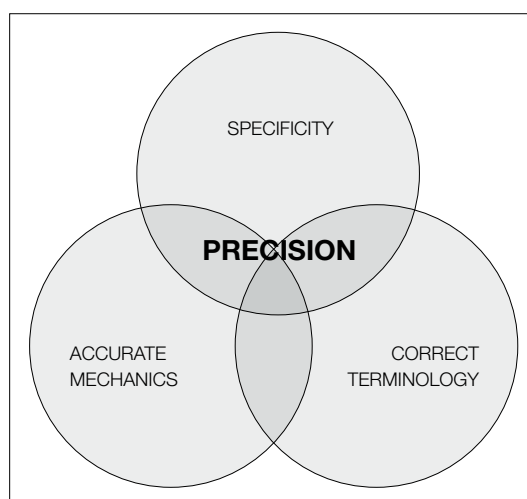


Figure 3. Aspects related to precision.

our own text perfectly. One good way to put yourself in your reader's shoes is to put your text aside for as long as possible and then reread it. Another way to detect imprecision is to have others read your texts before you send them off.

Note also that different terms for the same concepts often coexist and are sometimes used interchangeably. For example, the terms "arterioureteral fistula" and "ureteroarterial fistula" are used with about the same frequency in the literature. Some authors prefer "arterioureteral fistula" because the primary symptom is hematuria caused by blood flowing from the artery to the ureter. Other authors prefer "ureteroarterial fistula" because these fistulas nearly always result from primary ureteral disease due to the iatrogenic effects of irradiation and/or surgery for urogenital malignancies. Regardless of which term you choose to use in your article, you need to use it consistently throughout (see *Fluidity: Keeping the thread*).

Remember, too, that the terminology evolves. As knowledge advances, new classifications are proposed. New terms based on better understanding of different phenomena are rarely adopted by all authors immediately. In fact, the older terminology may coexist with the new for long periods of time. For example, in about 2005, a committee of experts proposed the term “acute kidney injury” to replace “acute renal failure”, yet many articles published in 2012 continued to use the older term. Similarly, better understanding of the histology underlying the clinical conditions referred to as “congenital cystic adenomatoid malformation” led to the coining of a more appropriate term, “congenital pulmonary airway malformation” in 1977. The old term, however, predominated in the literature through 2012, and it is only in the last couple years that the newer term is becoming more common than the older one, although it is far from replacing it. It can therefore be difficult sometimes to choose the best term. Although your choice should be guided by the articles you cite, remember that you have the final decision and the final responsibility for your choices. Avoid perpetuating erroneous or misleading terms, but be aware that others may be more familiar with classic terms.

Strive to become an expert at obtaining information about words from the internet. Nowadays, the first step in internet searching is usually Google. Google has many useful tools to help you find the appropriate words to say what you really mean. Google translate is sometimes the best place to start if you have no idea how to say something in English. Check the results by searching for the results (place them between quotation marks) in the web or in Google Scholar (see also *Using Google as a concordancer*). Google also allows

you to check the meaning of words and phrases by typing “define:” followed by the term you want to check. If you are looking for the right word for an object or anatomical structure, you can check possibilities by searching for images.

Multilingual websites are also useful for checking terminology across languages. You can search for a term in your native tongue in Wikipedia and then click on the equivalent page in English. The United States’ National Library of Medicine and National Institutes of Health maintain Medline Plus® to provide patients and their families with information about diseases, conditions, and related issues in both English and Spanish. The University of Maryland Medical Center maintains a bilingual (English-Spanish) medical encyclopedia with similar information. The World Medical Association and the World Health Organization also publish a wide variety of materials in multilingual formats.

Many errors in vocabulary and usage come from confusing similarities among English words and from misleading similarities with words in your mother tongue. The following exercises aim to give you practice in choosing the best word for each occasion.

Being specific

Writing in general rather than specific terms forces readers to try to fill in the gaps. By being specific, you can help make sure readers understand the actual message you mean to convey. Note, however, that there is nothing wrong with general terms *per se*. Some of the sentences in the exercise below might be correct in certain contexts, for example, immediately after or before we have defined or specified their elements.

Exercise 7

Use your imagination to rewrite the following sentences and make them more specific.

EXAMPLE: The patient presented with a lesion on her leg.

A 25-year-old woman presented with a laceration on the outer aspect of her left thigh.

- 1) Patients with altered Glasgow Coma Scale score were excluded from the analysis.

- 2) A considerable number of the samples were contaminated.

- 3) Bacteria were isolated from body fluids, so antibiotics were administered.

- 4) We observed a large increase in the cells expressing more Orai1.

- 5) After administration of the new angiotensin-converting enzyme inhibitor, regional hemodynamic parameters were altered.

- 6) The skin lesions grew and changed color over time.

- 7) Most of the animals developed complications.

- 8) We report the case of a child who suffered abdominal lesions after ingesting a foreign body.

- 9) Experimental subjects underwent various tests to ensure they were healthy.

- 10) Modifications to the pH were associated with the death of microorganisms.

Being correct

Make sure that you use the right words (i.e., those that convey your idea correctly and precisely). Finding the right words to express what

you really mean can be difficult due to similarities in form and meaning, together with the seemingly arbitrary nature of accepted collocations.

Exercise 8

Multiple choice: choose the best alternative to fill the gaps.

- | | |
|---|---|
| 1) After working as a _____ doctor for four years, Mary decided she wanted to specialize in rehabilitation medicine.
a) primary
b) familiar
c) familial
d) family | 2) Are you _____ with bootstrapping techniques?
a) familiar
b) aware
c) conscious
d) experimented |
| | 3) The _____ Committee approved the protocol.
a) Ethic
b) Moral
c) Ethics
d) Ethical |

Continue

- 4) Determining whether extra-abdominal ____ is present is important in staging primary malignant liver tumors.
 - a) extent
 - b) affection
 - c) extension
 - d) affectation
- 5) ____ Mediterranean fever mainly affects people of Jewish, Arabic, or Armenian descent.
 - a) Family
 - b) Hereditary
 - c) Familiar
 - d) Familial
- 6) The white ____ is composed mainly of glial cells and myelinated axons.
 - a) matter
 - b) material
 - c) substance
 - d) mater
- 7) It would not be ____ to deprive patients with a life-threatening condition of a potentially beneficial treatment.
 - a) ethic
 - b) morale
 - c) ethics
 - d) ethical
- 8) The ____ of disease coding scheme records the number of positive regional nodes at pathological examination.
 - a) extent
 - b) extend
 - c) scope
 - d) range
- 9) If nonsteroidal anti-inflammatory drugs fail to relieve pain, ____ them with opioids.
 - a) substitute
 - b) replace
 - c) supplant
 - d) change
- 10) The ____ was good in all patients; some developed complications but none died or had permanent sequelae.
 - a) evolution
 - b) recovery
 - c) outcome
 - d) result

Exercise 9

Complete the following sentences using the correct word.

- 1) **irradiated/radiated**
 The pain _____ to his left jaw and arm.
 The prostate and involved lymph nodes were _____.
- 2) **review/revise**
 Please _____ my paper as soon as possible; I need to _____ it and respond to the reviewers' comments by Friday.
- 3) **implemented/implanted**
 Pacemakers are normally _____ under local anesthesia.
 After the protocol was _____, the rate of infections in the ICU decreased by 30%.
- 4) **beside/besides**
 She stood _____ me through all my troubles.
 _____ being obese, he is diabetic.

5) **foreword/forward**

Dr. Joyce wrote the _____ to her book on neural control of involuntary effectors.
I will _____ your message to the statistical editor.

6) **principal/principle**

In _____, an electrical potential is applied across a lipid bilayer membrane and the resulting currents are measured.
The _____ cause of dental caries is *S. mutans*.

7) **continually/continuously**

He was fitted with a Holter device to monitor his heart _____.
We tested the patient's reflexes _____ over the three-day period.

8) **administer/administrate**

The drug's effects are much more rapid when you _____ it intravenously.
The university decided to _____ the laboratory directly.

9) **unsafe/insecure**

The toddler was _____ unless she had her teddy bear.
The drug was considered _____ for children.

10) **notice/realize**

I didn't _____ that he was only 5 years old—he is so tall for his age.
Did you _____ that he already reads quite well?

11) **located/localized**

MRI _____ the lesion in the lumbar spine.
Topical application of formalin-soaked-pledgets is effective for controlling _____ bleeding secondary to radiation cystitis.

12) **ileum/ilium**

Osteomyelitis of the _____ is uncommon.
Crohn's disease that affects the _____ can increase the risk of gallstones.

13) **delayed/postponed**

The meeting was _____ because the surgeon had an emergency call.
The diagnosis was _____ because the medication masked the symptoms.

14) **fewer/less**

We have done _____ procedures this month than last.
We have made _____ money than last month.

15) **excise/resect**

The infiltrative nature of the tumor and its difficult location made it impossible to _____.
If they _____ one lobe of her liver, she has a good chance of full recovery.

16) **patent/permeable**

The blood-brain barrier becomes more _____ during inflammation.
The common carotid artery was occluded, but the internal and external carotid arteries were _____.

17) **various/varying**

_____ studies have corroborated these results.
Studies on the efficacy of the treatment have yielded _____ results.

Continue

- 18) **is/represents**
 Obesity _____ a major health problem in many developed countries.
 The dotted line _____ the mean concentration in the control group over time.
- 19) **absorption/adsorption**
 When calculating the dosage of some drugs in patients undergoing continuous renal replacement therapy, it is important to take _____ onto filters into account.
 Dietary fiber can help bulk up runny stools through _____ of excess fluid.
- 20) **reabsorption/resorption**
 In bone _____, osteoclasts break down bone and release the minerals into the blood.
 Vitamin-D-dependent _____ of calcium takes place in renal distal tubules.

Exercise 10

Decide whether the words *in bold italics* are used correctly in the following sentences. Suggest an alternative for incorrect usages.

- 1) a) We found no difference between **both** groups.
 b) **Both** groups of animals were administered isoflurane anesthesia.
 c) Which of **both** scales is more accurate?
- 2) a) **While** they were attending the congress, I was reorganizing the laboratory.
 b) Everything changed **while** I was away.
 c) Dr. Johnson responded to the reviewers **while** Dr. Sanchez redid the statistical analysis.
- 3) a) Five years after diagnosis, she is free **of** disease.
 b) Reagents for coagulation tests are made **of** rabbits' brains.
 c) These catheters are made **of** BD Vialon™ biomaterial.
- 4) a) Two studies are **underway** to test the safety of the drug in healthy volunteers.
 b) An investigation is **underway** to determine who was responsible for the accident.
 c) There is an **underway** discussion about the best way to wean patients from ventilators.
- 5) a) Axoplasmic transport occurs **along** the life of a neuron and is essential to its growth and survival.
 b) Most axonal proteins are synthesized in the cell body of the neuron and are transported **along** axons.
 c) Microtubules running **along** the length of the axon provide the main cytoskeletal tracks for transport.
- 6) a) Cystatin 6 is likely **implied** in the proliferation of pancreatic cancer.
 b) These findings **imply** that locally produced estradiol might be protective against Alzheimer's disease.
 c) Preliminary indications of decreased tissue accumulation **implied** from pharmacokinetic and pharmacodynamic characteristics of isepamicin favor once-daily dosing.
- 7) a) Our **experience** over ten years shows the procedure is feasible and safe.
 b) After four years of extensive **experience**, the drug was tested **in vivo**.
 c) Most patients undergoing chemotherapy for breast cancer **experience** nausea.

- 8)
 - a) Cell cultures were examined on a daily **basis**.
 - b) On the physical examination, dry rales were detected in the **basis** of the lung.
 - c) We could not rule out an underlying connective tissue disorder on the **basis** of the lung pathology alone.
- 9)
 - a) On arrival to the emergency department, the patient appeared perfectly **rational**.
 - b) The pharmacodynamics and pharmacokinetics of mycophenolic acid provide a basis for **rational** monitoring strategies.
 - c) What is the **rational** for dosing every 8 hours versus every 24 hours?
- 10)
 - a) The **personal** at our center are highly qualified.
 - b) Please keep your **personal** opinions to yourself.
 - c) She had a **personal** dispute with one of the laboratory assistants.
- 11)
 - a) Creatinine results from the breakdown of creatine phosphate in muscle and is usually produced at a fairly constant **rate**.
 - b) All the signals were simultaneously recorded by a 12-bit analogical-to-digital converter, sampled at a **rate** of 200 Hz, and stored on a personal computer.
 - c) Drug action relies on route of administration, **rate** of absorption, and manner of distribution.
- 12)
 - a) Candidates must demonstrate **competence** in statistical analysis.
 - b) Patients' **competence** and the availability of caretakers will be taken into account for decisions about discharge.
 - c) The **competence** for the grant is fierce.
- 13)
 - a) Patients who **carry** a central venous catheter must be monitored to detect the growth of bacteria, fungi, or yeasts.
 - b) Arterial injuries at the elbow **carry** a high risk of muscle necrosis.
 - c) Screening can identify unaffected individuals who **carry** a copy of the gene for an autosomal recessive disease.
- 14)
 - a) The foot ulcer had completely **cured** by the six-month follow-up.
 - b) The quest for a **cure** remains elusive.
 - c) Three days' antibiotic treatment is usually sufficient to **cure** a simple bladder infection in women.
- 15)
 - a) The probability of **missing** important findings increases with fatigue.
 - b) Data about the drugs' effects in children are **missing**.
 - c) Please state explicitly how you handled **missing** data.
- 16)
 - a) Our group has published over 100 articles **since** 2007.
 - b) **Since** you wrote the introduction, you can write the discussion, too.
 - c) **Since** the patient died, she rarely operates.
- 17)
 - a) Samples were considered **adequate** when they contained enough material to enable the analyses.
 - b) Metabolic inhibition using lyophilized reagents and reference strains is the most **adequate** technique for nonspecialized laboratories.
 - c) Washing hands with soap and water provides **adequate** prophylaxis in most cases.

Continue

- 18) a) We assessed physicians' **adherence** to hand-washing protocols.
b) The primary inclusion criterion was strict **adherence** to the low-carbohydrate diet.
c) An **adherence** in a joint can restrict movement and cause pain.
- 19) a) We have a protocol to ensure **security** when moving elderly patients.
b) Most biologists who changed fields cited lack of job **security** as a major reason.
c) We have taken all necessary precautions to ensure the **security** of our network.
- 20) a) The biologic half-life of methadone **varies** from 18 to 100 hours.
b) Estimates of the prevalence of autism **vary** widely.
c) The cost of genetic testing and counseling **varies** with the complexity of the case.
- 21) a) We could not decide **if** we should apply for the grant.
b) We could not decide **if** to apply for the grant.
c) We could not reach a decision about **if** we should apply for the grant.
- 22) a) **As** Bedford et al.,³⁴ we found a higher incidence of nephrotoxicity with continuous infusion.
b) **As** Bedford et al.³⁴ reported, the incidence of nephrotoxicity is higher with continuous infusion.
c) **As** was reported by Bedford et al.,³⁴ the incidence of nephrotoxicity is higher with continuous infusion.
- 23) a) **During** the 1990s, a concerted effort was directed at mapping the human genome.
b) Scientists from around globe worked on the project together **during** five years.
c) **During** this period, many exciting discoveries were made.
- 24) a) The woman **that** taught me how to use bootstrapping works in Barcelona.
b) All genetic information is contained in the sequence of the four nucleotides **that** make up DNA.
c) Adenine, **that** pairs with thymine in DNA, binds to uracil in RNA.
- 25) a) Student's t-test or the Wilcoxon rank-sum test was used to compare **continuous** variables.
b) Anesthesia was maintained by **continuous** infusion of ketamine and propofol.
c) **Continuous** administration of low-dose capsules yielded the same benefits as **continuous** infusion.

Exercise 11

Correct the mistakes due to the influence of Spanish in these sentences.

- 1) We could go to the fast-food restaurant. There's no air conditioning and you have to eat standing up, but it's very comfortable because it's just across the street from the hospital.
- 2) Sterile cloth drapes are easy to manipulate and resistant.
- 3) I'm sure we can count on the physicians, but I'm not so sure about infirmity.
- 4) Autoimmune diseases are a subset of immunomediated diseases.
- 5) The pleuroesophageal recess is the interface of the subcarinal portion of the mediastinum and the right lower lobe.
- 6) The effectivity of the treatment has been questioned.
- 7) The specificity of the test vacillates between 67% and 89%.

- 8) Lymph-node affectation at initial diagnosis is this most reliable predictor of poor evolution.
- 9) After recanalization, the vessel was permeable.
- 10) A cell doubles itself when it divides.

Exercise 12

Find and correct the false friends in the following sentences.

- 1) The patient had a familiar history of high tension.
- 2) The diagnostic of tendonitis could not be discarded on the simple X-ray.
- 3) A unique malignant fibrous histiocytoma was seen in the posterior part of the left auricle.
- 4) The scientific rested in his office all night revising the literature.
- 5) You can get a copy of my last book at the library for €36.
- 6) I'd better not shake your hand—I'm constipated.
- 7) We performed TRUS biopsy using two preservatives over the probe.
- 8) Breast MRI is very sensible but not very specific.
- 9) Lobular pneumonia is usually caused by *Streptococcus pneumoniae*.
- 10) We had to call security because ten of her parents crowded into the room, molesting the girl in the other bed.

Exercise 13

Find and correct the vocabulary mistakes in the following sentences.

- 1) Arthrosis can affect any joint.
- 2) She was eventually diagnosed with ulcerous colitis.
- 3) It is impossible to detect osteoporosis with osseous gammagraphy.
- 4) At least 12 lymphatic ganglia should be resected to search for potential tumoral affectation.
- 5) Helicoidal CT scans can detect acute pulmonary thromboembolism.
- 6) Congenital cardiopathies are the most common type of congenital anomaly.
- 7) We describe a new technique to study the physiopathology of myocardiocytes.
- 8) The hematoencephalic barrier prevents some chemotherapy drugs from entering the brain.
- 9) There were some suspicious findings on her mammography so we should do an echography exploration.
- 10) My wife was embarrassed—she had an abortion in the sixth month.

Using the right register

Scientific writing should be formal. Do not use contractions or colloquial language.

Exercise 14

Identify the words in these sentences that are too informal and replace them with others in a more appropriate register.

- 1) The tumor was a bit hyperintense with respect to the liver parenchyma.
- 2) We detected lots of metastases in her lungs.
- 3) Anyway, increased clearance would not explain the enhanced effects of quinidine on repolarization in women.
- 4) We looked into the use of immunoassay and high performance liquid chromatography for therapeutic monitoring of vancomycin.
- 5) Plenty of theories have been proposed to explain these phenomena, but none have gotten wide support.
- 6) Although the resolution of fluorescence *in situ* hybridization is pretty good, it is limited by the resolution of the microscope used.
- 7) The operation was put off because the patient developed respiratory failure.
- 8) After the procedure, she got better fast.
- 9) Anyhow, a lot of other authors have pointed out flaws in the design of this study.
- 10) It is impossible to get rid of all contaminants in the laboratory.

Grammar

Correct grammar is essential to communication. Meaning is determined both by the words we use and the way we put them together. Consider the simplest of examples: *Mary hit John* means something very different from *John hit Mary*. This section deals with problematic areas like the use of articles, subject-verb agreement, prepositions, relative clauses, adverb placement, dangles, and verb patterns.

Articles

The basic principles guiding the use of articles are easy to grasp, but particular uses differ between languages. If you have difficulties with the following exercise, you would benefit from a general review of articles in a good grammar book.

Exercise 15

Correct the mistakes in the use of articles in these sentences when necessary.

- 1) The lab manager made them the promise that he would help them learn the technique.
- 2) Without a shadow of doubt, Dr. August is the better of the two candidates.
- 3) We lost the respect for her when she lost the control of herself and threw the beaker with the contaminated sample on the ground.
- 4) In short term, there was no significant difference between the two groups; however, in long term, the Group A had the better survival than the Group B.
- 5) The prevalence of diabetes in Spain may be as high as a fourteen percent.

- 6) They did not take an opportunity to present the results at the congress.
- 7) When I was a student, I hated the chemistry.
- 8) He is good man; it was pleasure to do the business with him.
- 9) I was late for the work because I went to a bank.
- 10) She made a effort to finish her review before the deadline.
- 11) She has a MSc in the technical writing.
- 12) Dr. James is in meeting—I'll go and get him.
- 13) A laboratory needs the professionals from many different backgrounds.
- 14) The MRI scanners have revolutionized radiology.
- 15) The breast cancer causes about 40,000 deaths a year in United States.
- 16) The burnout is a major problem in the emergency departments.
- 17) He was interviewed in newspaper, on radio, and on TV.
- 18) I explained how an enzyme is inactivated at a molecular level.
- 19) In the India, the teleradiology is likely to become a billion-dollar industry.
- 20) The university is cutting back on travel expenses for researchers.

Subject-verb agreement

The basic idea of subject-verb agreement is simple: singular or uncountable subjects take a singular verb, and plural subjects take plural verbs. However, putting this idea into practice is sometimes tricky. These guidelines can help you make sure your subjects and verbs agree in number.

COMPOUND SUBJECTS

When the subject consists of two or more singular or plural nouns or pronouns connected by "and", you need to use a plural verb.

- *Watson and Crick are having a party to celebrate publishing their article in Nature.*
- *Plain-film X-rays, US, CT, and MRI are the main imaging modalities in our department.*

Note, however, that when the nouns connected by "and" refer to the same person or thing, you need to use a singular verb.

- *"Accidents and Emergencies" is a common British term for the emergency department.*
- *The secretary and treasurer of our society has resigned.*

When the subject consists of two or more singular nouns or pronouns connected by "or" or by "nor", you need to use a singular verb.

- *The lab manager or his assistant has to sign the request.*
- *Neither the lab manager nor his assistant has signed the request.*

When the subject consists of a combination of a singular noun or pronoun and a plural noun or pronoun connected by "or" or "nor", you need to make the verb agree with the element that is nearer the verb.

- *The first author or her coauthors are going to speak at the press conference.*
- *Her coauthors or her husband is coming with her.*
- *Neither the author nor her coauthors have any conflicts of interest.*

INTERVENING PHRASES

Information placed between the subject and the verb is a common source of error. You should make sure the verb agrees with the subject, regardless of what comes between them.

- *One of the residents is always on call.*
- *Nurses who work in the emergency department are under incredible stress.*

This principle also applies to expressions that might seem to suggest "and", for example: with,

together with, including, accompanied by, in addition to, or as well as.

- *The head of the department, as well as her team members, is satisfied with the result.*
- *The talk, including all the photos of the speaker's lab, was boring.*
- *The researcher with all the grants works across the hall from me.*

PRONOUNS

Anybody, anyone, each, each one, either, everyone, everybody, neither, nobody, no one, somebody, and someone are singular, so you need to use a singular verb.

- *Each of these findings was confirmed at histological analysis.*
- *Everybody wants to work with Dr. Harmon.*
- *Neither of the two options is viable.*

Nouns following “each” or “every” need a singular verb.

- *Every article she has published is excellent.*
- *Each option has advantages and disadvantages.*

TRICKY NOUNS

Some nouns that refer to objects made up of two parts (e.g., scissors, trousers, eyeglasses) are considered plural. But note that when we use “a pair of” together with these nouns to refer to these objects, they take a singular verb.

- *Her glasses are very fashionable.*
- *Those tweezers are made of stainless steel.*
- *A pair of goggles is lying on the countertop.*

Some nouns that look plural are uncountable or singular.

- *Shingles is caused by the same virus that causes chicken pox.*
- *Rickets is usually caused by a lack of vitamin D and calcium.*
- *Mumps (epidemic parotitis) is a viral disease.*

Other nouns that look plural can be singular or plural depending on their meaning in context. These include but are not limited to nouns that end in –ics, which are singular when used to refer to a field of knowledge but plural when used to refer a specific concrete application of that knowledge.

- *Logistics is the management of the flow of resources.*
- *The logistics of the procedure are extremely complicated.*
- *The homologous series of straight-chained alkanes begins with methane, ethane, propane, butane, and pentane.*
- *It is not often possible to state whether two metabolic time series are significantly different.*

Do not confuse Latin and Greek singular and plural forms (see Appendix IV).

- *Mitochondria are the powerhouses of the cell.*
- *The crises were precipitated by a series of emotional shocks.*

NUMBERS AND AMOUNTS

Be careful expressing numbers, as these can be singular or plural depending on their context. A subject that refers to a single measurement, amount, or time takes a singular verb, whereas a subject that refers to a number of individual items normally takes a plural verb.

- *Forty thousand dollars is the mean amount awarded to second-year fellows.*
- *Even in the Euro zone, dollars are often used to express costs in studies.*
- *Three 100 mg doses in eight hours is too much.*

Fractions and percentages can be singular or plural depending on the noun that comes after them.

- *Nearly two-thirds of the fluid in mammalian organisms is contained in the intracellular compartment.*
- *Nearly two-thirds of the patients report a substantial improvement after the procedure.*

- *About 50% of the rats have recovered.*
- *About 50% of the population is at risk.*

The expression “the number of” always requires a singular verb, whereas the expression “a number of” always requires a plural verb“.

- *The number of applicants has doubled in three years.*
- *A number of genes are involved in the pathogenesis.*

All, any, most, none, some can be either singular or plural, depending on the meaning we want to convey.

- *All the glory goes to the one who publishes the idea first.*
- *All the patients survived without sequelae.*
- *None (i.e., not one) of the antibiotics was able to kill more than 50% of the bacteria= None (i.e., not any) of the antibiotics were able to kill more than 50% of the bacteria.*
- *None (i.e., no amount or no part) of the unbound drug was detected in urine after 48 h.*

COLLECTIVE NOUNS

These words refer to a group of people or animals. These nouns normally take a singular verb. However, especially in British English, they can take a plural verb when the members of the group are seen to be acting as individuals. In the latter case, it is always possible to insert “members” in the sentence to avoid someone considering you have made a mistake in subject-verb agreement.

- *The committee has unanimously chosen Dr. Bryson for the position.*
- *The committee are taking their seats at the head table ⇒ The members of the committee are taking their seats at the head table.*

THERE IS/THERE ARE

In phrases that begin with “there is” or “there are”, the subject comes after the verb.

- *There is a large hyperintense lesion in the left lobe of the liver.*
- *There are three types of biological safety cabinets.*

However, when the construction “there is” or “there are” is followed by a compound subject, it usually sounds more natural when the verb agrees with the first item in the list.

- *There is a large solid lesion and several small cystic lesions in the right breast.*
- *There is a mole or some clustered freckles just below the antecubital fossa.*

Remember that sentences containing “there is” or “there are” can often be improved by rephrasing.

- *There are many viruses that can cause disease in humans ⇒ Many viruses can cause disease in humans.*

MISCELLANEOUS GUIDELINES

Adjectives used as nouns take the plural form of the verb.

- *The poor have no access to healthcare.*

When a sentence has both a positive and a negative subject, the verb should agree with the positive subject.

- *The attending physician, not the researchers, is responsible for recording adverse events.*
- *The immune mediators, rather than the endotoxin itself, were the key to understanding the reaction.*

Plural titles take a singular verb.

- *Lewis Thomas's book The Lives of a Cell is a collection of musings on biology and life.*

Mathematical expressions take singular verbs.

- *Ten times three is thirty.*

Exercise 16

Put the verb in parentheses in the correct form to agree with subject.

- 1) Analgesics _____ (ACT) in various ways on the peripheral or central nervous system.
- 2) Bioinformatics _____ (BE) among the fastest growing fields today.
- 3) Mumps (epidemic parotitis) _____ (BE) a viral disease.
- 4) I'm afraid the news _____ (BE) not very encouraging.
- 5) Diabetes _____ (BE) more common among overweight people.
- 6) The statistics about teenage pregnancy (BE) _____ depressing.
- 7) Molecular cytogenetics _____ (USE) techniques like fluorescence *in situ* hybridization to study specific regions of the genome.
- 8) Transgenics _____ (BE) increasing being used as experimental models in biomedical research.
- 9) The logistics of the experiment _____ (BE) extremely complex.
- 10) Our series _____ (BE) the largest published before 2000; since then, two larger series _____ (BE) published.
- 11) A number of methods _____ (BE) used in our lab.
- 12) A total of 800 mL serous fluid _____ (BE) drained from the pleural space.
- 13) A total of 465 patients _____ (BE) enrolled at the five centers.
- 14) Shingles _____ (BE) caused by the same virus that causes chicken pox.
- 15) Neither the obstetrician nor the midwife _____ (BE) able to turn the baby from the breech position to avoid a caesarian.
- 16) Whether the doctor or the nurses _____ (RUN) the ward is a matter of opinion.
- 17) The acoustics in the auditorium _____ (BE) so bad that nobody could understand half of what Dr. Johnson was saying.
- 18) Bioethics _____ (DEAL) with ethical controversies developing due to advances in biology and medicine.

Exercise 17

Underline the correct form of the verb.

- 1) Dr. Jones [has, have] stated three good reasons why we need to redesign the first experiment.
- 2) William and Tim [does, do] the preliminary analyses.
- 3) The original tissue or these specimens [was, were] contaminated.
- 4) Either her analyses or your summary [is, are] full of errors.
- 5) One of her colleagues [is, are] going to present the preliminary results of the study.
- 6) Gould et al.²³ [points out, point out] several methodological errors in Jensen's study.
- 7) The woman with all the grad students [works, work] in my department.
- 8) The residents, as well as the chief, [thinks, think] it'd improve their training.
- 9) The article, including all the tables and figures, [takes, take] about three hours to read.
- 10) Either approach [yields, yield] valid results.
- 11) Either Dr. Leavitt or Dr. Darnell [is, are] going to be listed as the first author.

- 12) Every one of those articles [was, were] published before Martin et al.'s landmark study.
- 13) Nobody [know, knows] whether this approach would be cost effective.
- 14) [Is, Are] the news good or bad?
- 15) Her goggles [was, were] splattered with blood.
- 16) [Has, Have] the forceps been sterilized?
- 17) That pair of pajama pants [is, are] threadbare.
- 18) The statistics [is, are] promising: it looks like we are onto something.
- 19) Statistics [is, are] one of the most important analytical tools we have.
- 20) The Ethics Committee [has, have] waived the requirement for informed consent.
- 21) The committee [expresses, express] diverse opinions in private.
- 22) The chief, together with her assistant, [welcomes, welcome] the new residents.
- 23) All of the samples, even the spoiled one, [is, are] in the freezer.
- 24) A hundred euros [is, are] the price of a kit that can do 4000 colorimetric microplate assays.
- 25) There [was, were] seven candidates for the position. Now there [is, are] only one left!

Exercise 18

Correct the use of Latin plurals in these sentences; note that some sentences are correct.

- 1) A stent was placed in the left intraventricular foramina.
- 2) Infective episodes included three aplastic crisis due to parvovirus.
- 3) Both bronchi were widened and scarred.
- 4) Please include any acknowledgments, references, figure legends, tables, and appendix in the main document after the body of the text.
- 5) Three emboli were removed by aspiration.
- 6) Most virus are too small to be seen with an optical microscope.
- 7) We report seven new locus for genes involved in age-related macular degeneration.
- 8) Note how the parietal pleura and the visceral pleura connect at the hila of the left lung.
- 9) The only exclusion criteria was hypertension.
- 10) The vasculitis are inflammatory diseases of the walls of blood vessels.
- 11) Staphylococci is a Gram-positive bacteria that divides along multiple axes, resulting in grape-like clusters.
- 12) Gadolinium-based contrast mediums should not be used in patients with severe renal failure.
- 13) Bulla are fluid-filled sacs under a thin layer of skin that measure at least 1 cm in diameter.
- 14) We obtained gravimetric readings from absorbent pads placed in both axilla.
- 15) Multiple stenoses were found in 34% of the patients.
- 16) The alveolus are the terminal ends of the respiratory tree.
- 17) In the gastrointestinal tract, stomata are created in esophagus, stomach, small bowel, or large bowel.
- 18) Does apoptosis contribute to disease progression in heart failure or is it a phenomena observed only in end-stage heart failure?
- 19) Petechia on the soft palate are associated with streptococcal pharyngitis.
- 20) The cultured cells are seeded onto exogenous extracellular matrices that are made from bio-compatible and biodegradable polymers.
- 21) About 15% of cells have at least two nucleus.

Continue

- 22) Ganglions are bundles of somata and dendrites that act as relay points between different neurological structures.
- 23) There were multiple metastasis in the brain.
- 24) The spleen and the liver are abdominal viscera.
- 25) Two fungus are responsible for most cases of athlete's foot.

Prepositions

Prepositions are essential for showing the relationships between elements, but preposition use varies among languages. Even closely related languages like the Romance languages often differ in their choice of prepositions in some cases.

Learners of English often find preposition use to be idiosyncratic, and knowing which preposition to use is often a challenge even for very advanced learners.

Exercise 19

Complete the following sentences with the correct preposition indicating place or direction (along, to, toward, on, onto, in, or into). Some sentences may have more than one possible correct answer. Remember that a few verbs of motion take only "on" rather than "onto."

- 1) Oxygenated blood returns _____ the heart through the pulmonary veins.
- 2) Insulin is released _____ the blood.
- 3) Neurotransmitters are stored _____ the synaptic bouton and are released _____ the synaptic cleft.
- 4) The patient is placed _____ the table in the prone position.
- 5) When bacterial biofilm forms _____ the surface of a medical implant, even high doses of antibiotics cannot remove it completely.
- 6) The right marginal vein courses _____ the right cardiac border and may drain _____ the right atrium.
- 7) Microvilli are fingerlike projections seen _____ the surface of some cells.
- 8) B cells develop immunocompetence _____ the bone marrow.
- 9) The sample is pipetted _____ the slide.
- 10) To ensure an optimal signal, place the sensors _____ an area of the skull with few muscle fibers.
- 11) We went _____ the national congress.
- 12) The catheter is inserted _____ the femoral artery.
- 13) Infection developed after a surgical sponge was accidentally left _____ her abdomen.
- 14) Dr. Karper's team is advancing _____ an understanding the pathways involved.
- 15) Vega and colleagues reported a trend _____ reduced LDL-receptor-mediated clearance of LDL.
- 16) An HMG CoA reductase inhibitor can lower the plasma cholesterol concentration _____ or near acceptable levels.
- 17) The patient went _____ an irreversible coma.
- 18) The cardiology resident noticed an abnormality _____ the EKG.
- 19) The spermatozoa swam _____ the ovary extracts, even though they were extremely diluted.
- 20) Two substrate molecules attach _____ the active site of the enzyme.

Exercise 20

Complete the following sentences with the correct preposition of place (*above, across from, around, at, behind, below, between, by, close to, in, inside, near, next to, on, opposite, outside, over, under, within*). Some sentences may have more than one possible correct answer.

- 1) Tight junctions _____ endothelial cells of the blood-brain barrier restrict paracellular diffusion of water-soluble substances from blood _____ the peripheral circulation to tissues _____ the central nervous system.
- 2) The cytoskeleton provides a track-like system that directs the movement of organelles and other substances _____ cells.
- 3) The endoplasmic reticulum transports molecules created by the cell to their specific destinations either _____ or _____ the cell.
- 4) It is essential to look _____ the heart when viewing frontal X-rays because some abnormalities are often located solely or partially _____ the retrocardiac region.
- 5) Lesions were classified as suprasellar when located _____ the sella turcica and as infrasellar when located _____ this structure.
- 6) A bicarbonate-rich acid-impermeable mucus secreted by the cells of the surface epithelium forms a thin layer _____ the entire gastric mucosa.
- 7) In sublingual administration, drugs diffuse into the blood through tissues _____ the tongue.
- 8) In the prophase of mitosis, the centrioles position themselves _____ one another at _____ ends of the cell.
- 9) The liver lies in the abdominal cavity, _____ the stomach.
- 10) Ribosomes are tiny organelles that can be found _____ the cytoplasm or _____ the surface of the rough endoplasmic reticulum.

Exercise 21

Complete the following sentences with the correct preposition of time (*after, ago, at, before, between, by, during, for, from, in, on, since, to, until, up to, within*). Some sentences may have more than one possible correct answer.

- 1) T cells were discovered _____ the 1970s.
- 2) Dr. Bern reported the preliminary results at the European Congress two years _____.
- 3) We included all consecutive patients admitted to the ICU _____ January 1, 2011 and December 31, 2012.
- 4) A total of 16 adverse events were recorded _____ the study period.
- 5) The solution was heated _____ homogeneous.
- 6) The effects of carisoprodol begin _____ 30 minutes of oral administration and last _____ four to six hours.
- 7) The two oligonucleotides were first incubated with RPA (30 nm) _____ 5 min in DNA annealing buffer supplemented with 1 mM ATP.
- 8) The parent compound, cisplatin, is excreted in the urine and accounts for 13% to 17% of the dose excreted _____ one hour _____ administration of 50 mg/m².
- 9) All variables were recorded again _____ the end of the observation period.
- 10) _____ 1981, a new glucocorticoid receptor antagonist known as RU 38486 was synthesized.
- 11) _____ the fall and winter, men's estrogen levels increased and testosterone production decreased.

Continue

- 12) _____ incubation for 5 min, Rad52 (40 nm) and/or Rad59 (80 nm) were added to initiate the reaction.
- 13) All patients provided informed written consent _____ agreeing to participate in the experiment.
- 14) The study was discontinued _____ the fifth day because the preliminary results suggested that the risks outweighed the benefits.
- 15) A greater proportion of adverse events occurred _____ night than _____ the day.
- 16) All patients who have not died or relapsed _____ the end of the follow-up period will be considered disease-free.
- 17) She was in a coma _____ April 3 _____ June 19.
- 18) The FDA approved the new drug application _____ May 4, 2011.
- 19) More than 25 million people have died of AIDS _____ it was discovered _____ 1981.
- 20) _____ Saturdays, Sundays, and holidays, the department is staffed by residents and an attending physician is on call at home.

Exercise 22

Complete the following sentences with the correct preposition: *at, in, or on*.

- 1) The PET/CT scanner is located _____ another building.
- 2) The pharmacology department is _____ the sixth floor.
- 3) Dr. Paul is _____ the operating room.
- 4) We didn't plan to spend a long time _____ the seminar.
- 5) Tell them to wait for me _____ the entrance to the ICU.
- 6) Do they live _____ the city or _____ the country?
- 7) Dr. Finstadt arrived _____ the electrophysiology suite well in advance.
- 8) The patient was being carried _____ a stretcher.
- 9) After talking _____ the phone for half an hour, I developed a terrible pain _____ my neck!
- 10) _____ that time, I was a grad student, just learning how things worked.
- 11) The use of electronic devices is forbidden _____ some parts of the hospital.
- 12) There were so many fingerprints _____ the screen that we could hardly see the image.
- 13) A fragment of the catheter had broken off and become lodged _____ the left pulmonary artery.
- 14) A nurse will inform you shortly; in the meantime, please wait _____ the waiting room.
- 15) If Dr. Michaels doesn't learn to write better reports, she'll be out _____ the street.
- 16) I use my cell phone when I'm _____ the ward, but never while I'm _____ the operating room.
- 17) Please hurry up! I want to get there _____ time to see the opening lecture.
- 18) She's always very punctual—she's always _____ time.
- 19) The lab is located _____ Seventh Avenue.
- 20) Dr. Thomson works _____ the field of cell biology, while Dr. Fernandez works _____ molecular biology.

Exercise 23

Complete the following sentences using *in, into, on, onto, to, or toward*. More than one answer may be correct in some.

- 1) Dr. Kaiser has returned _____ the university where he did his postdoc.

- 2) We are working _____ a better understanding of the role of prostaglandins _____ inflam-
mation.
- 3) She was put _____ a stretcher and taken away _____ an ambulance.
- 4) Sensory nerves convert external stimuli _____ internal stimuli.
- 5) My office is _____ the East Wing.
- 6) Advance the catheter _____ the heart, but stop about 5 cm before you reach it.
- 8) Take any bus that heads _____ the university.
- 9) Are the department chiefs still _____ the meeting?
- 10) "Please hang _____ . Dr. Browning is _____ another line right now."
- 11) Dendrites carry impulses _____ the body of a neuron.
- 12) Dr. Gould walked _____ the stage and began his lecture.
- 13) The drunk vomited _____ the bed _____ the examination room.
- 14) Dr. Rimini thanked us for listening and told us to carry _____ with our work.
- 15) Are you planning _____ going _____ the session?
- 16.) While being transferred _____ a nursing home, the patient fell _____ the floor.
- 17) Dr. Walker got _____ trouble over his comments _____ the resident.
- 18) The term ascites refers _____ fluid _____ the peritoneal cavity.
- 19) I'll take you _____ the conference center.
- 20) She left her goggles _____ the counter.

DEPENDENT PREPOSITIONS

Appendix V gives a list of some common dependent prepositions.

Exercise 24

Complete the following sentences with the correct verb-dependent preposition.

- 1) Diuretics can interfere _____ calcium absorption.
- 2) We analyzed the factors associated with failure to adhere _____ the regimen.
- 3) Women diagnosed with osteoporosis were invited to participate _____ the study.
- 4) One shortcoming of our study is we had to rely _____ patients' self reports.
- 5) In most cases, cholangiography cannot distinguish recurrent primary sclerosing cholangitis
_____ other conditions.
- 6) In most cases, cholangiography cannot distinguish _____ recurrent primary sclerosing
cholangitis and other conditions.
- 7) Monoclonal antibodies excel _____ the identification of antigens because cross-react-
ing antibodies are absent.
- 8) A 52-year-old man complained _____ a severe precordial crushing sensation with
pain radiating to the left shoulder.
- 9) Compared to intensive care physicians, nurses were more likely to comply _____
hand-washing recommendations.
- 10) All the reviews commented _____ the small sample.
- 11) The right and left coronary arteries arise _____ the aorta.

Continue

- 12) The critical care team responded _____ the code.
- 13) The vascular wall consists _____ several layers (tunica adventia, tunica media, and tunica intima).
- 14) The patient refused to consent _____ a blood transfusion.
- 15) This is an emergency that calls _____ immediate surgical intervention.
- 16) It can take up to a month to fully recover _____ shingles.
- 17) Common normal anatomic variants can easily be mistaken _____ pathology on plain-film X-rays.
- 18) The patient will have to choose _____ a metallic valve and a biologic valve.
- 19) The treatment will depend _____ the patient's underlying condition and comorbidities.
- 20) Systemic risk factors may also contribute _____ treatment failure.

Exercise 25

Complete the following sentences with the correct adjective-dependent preposition.

- 1) The tablet is coated _____ a pH-sensitive acrylic polymer so the drug is released in the distal ileum and colon.
- 2) All the *Streptococcus pneumoniae* isolates in this study were sensitive _____ cefixime.
- 3) All patients aged 18 years or older were eligible _____ the study.
- 4) The findings were consistent _____ chronic traumatic encephalopathy.
- 5) A low red blood count is characteristic _____ anemia.
- 6) Clinicians need to be familiar _____ these signs.
- 7) One Howell unit of heparin is approximately equivalent _____ 0.002 mg of pure heparin.
- 8) Patients with AIDS are susceptible _____ opportunistic infections.
- 9) The attending physician is legally responsible _____ the patient's care.
- 10) This peptide activates smooth muscle via a mechanism similar _____ ERK-mediated phosphorylation.
- 11) Reticulocyte RNA and functional minigene splicing assays in heterologous cells revealed that this mutation was associated _____ a complex pattern of aberrant splicing.
- 12) One month after the intervention, only 3% of patients were dissatisfied _____ the outcome.
- 13) Rats in the control group were exposed _____ filtered room air.
- 14) This experiment was based _____ earlier experiments reported elsewhere.
- 15) The statistics used were not suitable _____ the type of data analyzed.

Exercise 26

Complete the following sentences with the correct noun-dependent preposition.

- 1) Vitamin supplements are no substitute _____ a balanced diet.
- 2) The main advantage _____ endovascular repair was a lower rate of perioperative complications.
- 3) The reason _____ readmission was not noted in half of the patients.

- 4) None of the patients had adverse reactions _____ the drug.
- 5) There is a need _____ further studies with more patients.
- 6) Patients with valvular defects should be administered antibiotics as prophylaxis _____ endocarditis.
- 7) Myxedema can develop due to long-term hypothyroidism as a result _____ untreated Hashimoto's disease.
- 8) Major surgery results in period of cell-mediated immunosuppression that can have a negative impact _____ the patient's recovery.
- 9) This sharp decrease _____ streptomycin production was accompanied by a decrease _____ intracellular accumulation _____ ppGpp.
- 10) It is essential to understand the difference _____ cell-mediated and humoral immunity.

Exercise 27

Find and correct the errors in prepositions in the following sentences.

- 1) She was diagnosed of pericarditis and was admitted in the hospital.
- 2) The treatment consisted in daily wound care and watchful waiting.
- 3) The choice of antibiotic depends of which organism is causing the infection.
- 4) We aimed to determine the frequency, sites, and patterns of atypical metastases of prostate cancer.
- 5) If the pain worsens, substitute paracetamol for tramadol.
- 6) Divide the work up between all the residents.
- 7) We describe a technique for detecting cancer cells based in the interaction between a chemotherapy agent and cell membrane components.
- 8) At the six-month follow-up, all patients of the treatment group showed a significant decrease of total serum cholesterol.
- 9) We suspect the source of bleeding is a severed artery—please call to the vascular surgeon.
- 10) The abdominal CT revealed a foreign body into the jejunum.

Relative clauses

A relative clause is a kind of subordinate clause (containing a subject and verb) that usually functions as an adjective. Relative clauses are usually introduced by a relative pronoun (that, which, who, whom, or whose) or by a relative adverb (where, when, why), although the relative pronoun can be omitted when it is the object of a defining clause (see below).

Relative clauses are categorized as defining (also called restrictive) when the information they provide is essential to the meaning of the sentence or as non-defining (also called nonrestrictive) when they merely provide additional, parenthetical information.

Defining clauses are never separated from the rest of the sentence by commas. The relative pronoun *that* can only be used in defining clauses.

- *Biologists that (or who) start successful companies earn more money than biologists that (or who) work for government agencies.*
- *SNPs that (or which) are not in protein-coding regions may still affect gene splicing, transcription factor binding, or the sequence of non-coding RNA.*

The relative pronoun can be omitted when it functions as the object of the relative clause, although this is less common in formal writing.

- *The laboratory that I worked for was dismantled last year.* ⇒ *The laboratory I worked for was dismantled last year.*

Relative adverbs can never be omitted.

- *The laboratory where I work is very well funded.*

Non-defining clauses are always separated from the rest of the sentence by commas. The rela-

tive pronoun *that* cannot be used in non-defining clauses.

- *Dr. Davis, who was a fellow with me at Cornell, started his own company and is now a millionaire.*
- *The European Congress, which takes place in November, is the most important meeting in our field.*

Exercise 28

Complete the following sentences using a relative pronoun. If it is possible to omit the pronoun, put an asterisk after it.

- 1) Dr. Patricia McLean, _____ husband pioneered the procedure, is probably the best choice.
- 2) She consulted a cardiologist, _____ ordered a stress test.
- 3) If you need advice on microarray techniques, the person _____ you need to contact is Dr. Susan Lopez.
- 4) Professor Weiner, _____ achievements include the Founders' Award, will be giving the keynote address.
- 5) This book was written by the geneticist _____ spoke at the conference in Madrid.
- 6) The osteoid osteoma was located in the epiphysis, _____ is extremely rare.
- 7) You cannot perform the procedure _____ we did without CT fluoroscopy.
- 8) She was transferred to this ICU, _____ she developed multiple organ failure.
- 9) What's the name of the instrument _____ you used to examine the eardrum?
- 10) The room _____ the procedure is done must have excellent lighting.

Exercise 29

Punctuate the following sentences according to whether they contain defining (not separated from the rest of the sentence by commas) or non-defining relative clauses (separated from the rest of the sentence by commas). Sometimes the same clause could be either type, but in that case the meaning is different.

- 1) Dr. Safier who works at the Mayo Clinic was my roommate at college.
- 2) We need to arrange a blood transfusion for the patient who was just operated on.
- 3) The nurse who had more experience than the resident was able to avert a disaster.
- 4) The fellows who understand English well enjoyed the talk.
- 5) The renovation of the wet lab which was announced yesterday will help keep our center on the cutting edge of science.
- 6) The lab manager who is from India can be very difficult to understand.
- 7) We're looking for a biologist who is willing to get her hands dirty.
- 8) The stratum corneum which is the outermost layer of the epidermis consists of dead cells that lack nuclei and organelles.
- 9) They have done this procedure dozens of times before which is no guarantee that they will succeed this time.
- 10) The urologist who is going to operate on my prostate is very good.

Word order

To communicate effectively, you need to carefully consider both the words you use and the way you arrange them. Presenting known information before new information (more about that in *Fluidity: Keeping the thread*) makes your text easier to follow. However, another aspect of word order, the position of modifiers, not only affects readability, but also has a crucial effect on meaning.

Consider the difference in meaning in the following sentences:

- *We nearly received a grant for a million euros.*
⇒ We received nothing.
- *We received a grant for nearly a million euros.*
⇒ We received almost €1 million.
- *One aspect of brain function that has most fascinated neurobiologists is learning and memory.* ⇒ Neurobiologists are interested in various aspects of brain function, especially in learning and memory.
- *One aspect of brain function that has fascinated most neurobiologists is learning and memory.* ⇒ The majority of neurobiologists are interested in learning and memory.
- *Only I examined the specimen with a light microscope in my private laboratory yesterday.* ⇒ I am the only person who examined the specimen.
- *I only examined the specimen with a light microscope in my private laboratory yesterday.* ⇒ I examined the specimen; I did not process it, stain it, damage it, or alter it in any way.
- *I examined only the specimen with a light microscope in my private laboratory yesterday.* ⇒ I did not examine anything except the specimen.
- *I examined the only specimen with a light microscope in my private laboratory yesterday.* ⇒ There was only one specimen.
- *I examined the specimen only with a light microscope in my private laboratory yesterday.* ⇒ I did not use any other equipment (e.g., an electron microscope).
- *I examined the specimen with a light microscope only in my private laboratory yesterday.*
⇒ Not in the hospital or university laboratory (where the results might have been different?).
- *I examined the specimen with a light microscope in my only private laboratory yesterday.*
⇒ I do not have more than one private laboratory.
- *I examined the specimen with a light microscope in my private-only laboratory yesterday.*
⇒ This laboratory is dedicated exclusively to private practice.
- *I examined the specimen with a light microscope in my private laboratory only yesterday.*
⇒ I did not examine the specimen at any other time.

An old-fashioned English grammar rule is that you should never “split” an infinitive. Interposing an adverb between the two parts of the infinitive (to+verb) often results in awkward sentences. Look at these examples:

- *It was impossible to even recruit 30 subjects.*
(AWKWARD)
- *It was impossible to recruit even 30 subjects.*
(NATURAL & EFFECTIVE)
- *They always try to carefully do the analysis.*
(AWKWARD)
- *They always try to do the analysis carefully.*
(NATURAL & EFFECTIVE)

However, in other cases, the most natural and effective place to put adverb is in the middle of the infinitive. Look at these examples:

- *They asked me to supervise the experiments that are to be done personally.* (UNCLEAR—“personally” seems to modify “to be done”)
- *They asked me personally to supervise the experiments that are to be done.* (UNCLEAR—“personally” seems to modify “asked”)
- *They asked me to personally supervise the experiments that are to be done.* (CLEAR)
- *I want you to consider Callaway’s offer to manage our database carefully.* (UNCLEAR—“carefully” seems to modify “to manage”)

- *I want you to consider carefully Callaway's offer to manage our database.* (AWKWARD)
- *I want you to carefully consider Callaway's offer to manage our database.* (CLEAR & NATURAL)

As a general rule, place modifiers close to what they modify to avoid misinterpretation.

Modifiers with absent or only tenuous links to the elements being modified are called dangles.

Exercise 30

Place the modifier in the best position

- 1) I determined the viral load using branched DNA in the university lab yesterday.
(ONLY; I did not use real-time PCR)
- 2) To compensate for inflation, we asked them to review our project funding. (YEARLY)
- 3) The lab manager asked them to register the material they used. (STRICTLY)
- 4) I died when the contaminated specimen spilled on the counter. (NEARLY)
- 5) In patients with diabetes, poor peripheral circulation can increase the risk of infection.
(FURTHER)

Participle clauses

Participle clauses are formed with either the present (VERB+ING) or past (VERB+ED/irregulars) participles. Like relative clauses, participle clauses add more information to a sentence and act as adjectives. It can be useful to think of a participle clause as a kind of reduced relative clause. We use the present participle when the meaning is active and the past participle when the meaning is passive.

- *A report describing a new strain of H1N1 influenza was published last week.* (i.e., that describes)
- *Figure 3 shows a paramecium swimming in a thin layer of fluid.* (i.e., that is swimming in...)

Although the relative clause replaced by the present participle clause need not be in a continuous tense, we cannot use a present participle phrase to talk about a single finished action that was not repeated. Thus, instead of “*The man dis-*

covering penicillin...”, we need to say “*The man who discovered...*”.

- *We studied 50 cholangiocarcinoma specimens immunohistochemically stained with a marker for MAC387 and MMP-9.* (i.e., that had been immunohistochemically stained...)

BEING+ PAST PARTICIPLE can be used to express the idea of a continuous passive relative clause.

- *I think the boy being operated on this afternoon has anemia.*

Both present and past participle clauses can be used in introductory statements.

- *Working with Dr. Schmidt, I learned the importance of careful measurement.*
- *Detected when it was already stage IV, the carcinoma proved to be fatal.*

However, it is essential to make sure that it is perfectly clear what the participle clause is referring to. Dangling participle clauses (i.e., that do not have a clear connection to what is being modified) are among the most common mistakes in scientific writing. Look at the kind of mistakes that might have occurred if the examples above had been arranged differently. These mistakes are often difficult to see in your own work, but once detected, they are easy to correct.

- *Swimming in thin layer of fluid, I could see a paramecium.* (i.e., I was swimming)
- *Immunohistochemically stained with a marker for MAC387 and MMP-9, we studied 50 cholangiocarcinoma specimens.* (i.e., we were stained)
- *Being operated on this afternoon, I think the boy has anemia.* (i.e., I am being operated)

Exercise 31

Rearrange the following sentences so that the participle clause functions correctly.

- 1) After being denatured at 95°C, we use a primer-specific annealing temperature of 54°C.
- 2) Moving from a square detection region to a tapered detection region, we improved the signal by a factor of 2 and the SNR from 6.4 to 9.6.
- 3) Looking through the microscope, the drop of water seemed to come alive.
- 4) She sent the proposal to the director of the agency hoping for a grant.
- 5) Rehearsing his talk on the flight to the congress, a successful speech was unlikely.
- 6) Obstructed by adhesions, we resected a section of the small bowel and created an anastomosis.
- 7) Protruding through the skin of her left forearm, you could see the broken radius and ulna.
- 8) After listening to her explanation, the results made sense.
- 9) Inserting the distal tip of the chronic hemodialysis catheter too far into the atrium, the patient developed an arrhythmia.
- 10) Failing to record essential variables, the analysis was deeply flawed.
- 11) Focusing on the complications, uncontrollable bleeding is both the most common and the most dangerous.
- 12) Considering the consequences, intramuscular injection in the anticoagulated patient should have been avoided.
- 13) In performing colonoscopy, patients report greater satisfaction when sedated.
- 14) Wounded by knife, the surgeon checked the victim for internal injuries.
- 15) After explaining the possible benefits and risks involved, the patient signed the informed consent form.

Exercise 32

Rearrange these sentences so that it is clear what the modifiers are modifying.

- 1) Fellows who seek their tutors' advice often can improve their evaluation.
- 2) To carry out a successful research project, funds must be carefully administered.
- 3) She likes to listen to classical music analyzing the data.
- 4) Breeding freely in the cages, the undergraduates were delighted by the rats.
- 5) Dr. Joseph needs to do really well on his board examination.
- 6) An ameba appeared on the slide that moved all over the place.
- 7) Checking her blood pressure every 30 minutes, the results seemed to make more sense.

Continue

- 8) After reading her book, her talk is worth going to.
- 9) She gave the cultures to the fellows on lidded Petri dishes.
- 10) He had to repeat the course because he nearly failed every exam.

Verb patterns

When more than one verb is necessary to convey particular meanings, the verbs follow different patterns. These patterns are determined by the first verb.

Some verbs can be followed by an infinitive or gerund, with little or no difference in meaning.

- *They started sequencing individual genes from patient DNA.* = *They started to sequence individual genes from patient DNA.*

Other verbs admit only either the infinitive or gerund.

- *We expect to have the results next month.* ~~*We expect having*~~ is wrong.

- *You should avoid testing children for untreatable conditions.* ~~*You should avoid to test*~~ is wrong.

A few verbs have different meanings depending on whether they are followed by a gerund or an infinitive. We use these verbs together with the infinitive before we do something, and we use them together with the gerund while doing or after doing something.

	When followed by the infinitive	When followed by the gerund
forget	not do something because you did not remember <i>He forgot to ask permission to reprint the figure.</i>	do something but have no memory of doing it <i>He forgot telling her that he loved her</i> (i.e., he forgot that he told her that he loved her).
mean	have the intention to do something <i>I meant to ask you if I could use your slides for my class</i> (i.e., I was going to ask you).	imply doing something <i>Satisfying reviewer #4 means doing additional experiments.</i>
regret	feel bad about having to do something before you do it <i>We regret to inform you that we cannot pay your travel expenses.</i>	feel bad about having done something after you did it <i>I regret sharing my idea with him—he's adopted it as his own.</i>
remember	bear in mind that you have to do something <i>You must remember to include her in the acknowledgments.</i>	do something and have memory of doing it <i>I remember reading about a similar case in the NEJM.</i>
stop	end one action in order to begin another <i>We were working on our paper, but we stopped to watch the match.</i>	end an action that is progress <i>We stopped watching the match when it was obvious that our team couldn't win.</i>
try	aim to do something <i>We tried to explain it to him, but he just couldn't understand it.</i>	do something to see if it works <i>We tried everything: we tried using simple language, we tried showing him examples, we tried drawing a diagram, but he just couldn't get it.</i>

Exercise 33

Complete the sentences using the infinitive or gerund as appropriate.

- 1) Xavier plans _____ (APPLY) for a grant next month.
- 2) She dislikes _____ (DO) colonoscopies—she says her wrist hurts afterward.
- 3) The medical students practiced _____ (TAKE) medical histories.
- 4) Dr. Walker enjoys _____ (DRINK) whisky when he goes to congresses.
- 5) They hope _____ (OBTAIN) a government grant to continue their research.
- 6) If Dr. Comas keeps on _____ (WORK) so hard, she's going to get burned out.
- 7) He asked _____ (HAVE) the morning off to answer the reviewers.
- 8) Do you mind _____ (HELP) her with the statistical analysis?
- 9) Dr. Gould promised _____ (HIRE) him for the summer.
- 10) Dr. Hill suggested _____ (DO) an MRI to stage the tumor.
- 11) They agreed _____ (WRITE) a recommendation for me.
- 12) She never mentioned _____ (WORK) in Boston. How long was she there?
- 13) Dr. Stapleton decided _____ (TAKE) her children with her to the seminar.
- 14) Geraldine offered _____ (BUILD) the database for me.
- 15) The endocrinologists want _____ (SET) up a diabetic foot clinic.
- 16) Where did you learn _____ (WRITE) like that?
- 17) Dr. Whitbread appears _____ (BE) the best person for the position.
- 18) Dr. Williams chose _____ (ACCEPT) the fellowship in Cambridge.
- 19) I distinctly remember _____ (TELL) him to lock the lab before leaving.
- 20) He claims _____ (BE) an expert in biocomputing, but I don't believe him.

Exercise 34

Choose the best verb pattern.

- 1) Remember **to check / checking** on the cultures after lunch.
- 2) Lillian, I'm afraid I have some bad news—I regret **to tell / telling** you that we have hired someone else.
- 3) We tried **to use / using** different techniques, but none of them worked.
- 4) She can't go on **to work / working** without a contract; we must find a solution.
- 5) He stopped **to drive / driving** after his stroke.
- 6) Amy went on **to work / working** even after her grant money dried up.
- 7) Stephen went on **to win / winning** the Nobel Prize a few years later.
- 8) I regret not **to finish / finishing** my review in time.
- 9) I don't remember **to do / doing** the test, and I didn't record it in the lab log.
- 10) They tried **to resuscitate / resuscitating** the accident victim, but he died.

Exercise 35

Correct the mistakes in the use of verb patterns in these sentences.

- 1) What did happen at the meeting this morning?

- 2) A second molecular biology laboratory is constructed.

- 3) The operation has permitted that she lose 50 kg.

- 4) It is essential to remember entering the data in the database after each step.

- 5) They tried to give her noninvasive mechanical ventilation, but her condition did not improve.

- 6) Only three patients refused participating in the study.

- 7) The decrease failed reaching statistical significance.

- 8) The patient was sedated so he forgets to undergo the test.

- 9) We regret informing you that we cannot publish your article.

- 10) Dr. Severin cut her hair before her presentation at the American Congress.

Exercise 36

Choose the modal verb that best completes the sentence.

- 1) You _____ smoke in the lab—there is a danger of explosion.
a) mustn't b) may not c) might not
- 2) I was up all night finishing my manuscript. I _____ go to get some sleep.
a) should b) ought c) need
- 3) I left my stethoscope in the emergency department. _____ you lend me yours?
a) May b) Could c) Shall
- 4) The patient is hemodynamically unstable. You _____ do the procedure.
a) can't b) might not c) may not
- 5) You seem to have a huge backload of work. _____ I help you?
a) Would b) Will c) Shall
- 6) I saw your publication in *Nature*. You _____ be very proud!
a) might b) must c) shall

- 7) It's the law. You _____ to obtain approval from the institutional review board.
 a) might b) could c) have
- 8) She _____ have performed the experiment. She wasn't even in town last week.
 a) might b) shouldn't c) couldn't
- 9) Dr. Vila, we've finished running the experiment. _____ we take a break now, please?
 a) May b) Would c) Must
- 10) This was the busiest call in my four years of residency. You _____ be exhausted.
 a) might b) must c) may

Using Google as a concordancer

A concordancer is a computer tool for language study. When you enter a word, it looks through a large body of texts and lists every single example of the word. The results reveal interesting information about how common the word is in the corpus (the body of texts searched), the words that come before and after it in the texts, and the more general context and style associated with it.

Google (G) and Google Scholar (GS) are very useful for finding both the best term to express or translate concepts and the best word order. Try different combinations and enclose search terms within quotation marks to evaluate the suitability of alternative terms and collocations. It is sometimes useful to add a specific term from your field when searching to check more general language-related questions such as articles and prepositions.

For example, you may have seen both "informed written consent" and "written informed consent" (both forms are common, sometimes even within the same document). Which order is better? Look at the search results: Google finds about 1,400,000 results for "informed written consent". This seems to confirm that this word order is correct. However, if you search for "written informed consent", Google finds about 13,300,000 results. If you think that these results might be "contaminated" by texts directed at laypeople, you can search for the same terms in Google Scholar. In this case, Google Scholar finds 90,900 for "informed written consent" and 402,000 for "written informed consent". Thus, although both alternatives are correct, "written informed consent" is much more common than "informed written consent".

When evaluating the results of your search, look at the number of hits but remember that numbers are not everything, although huge differences probably signal that one alternative is more grammatical or more conventional than the other(s). Pay attention to the sources cited; for example, a search for "cardiopathies" yielded a respectable 324,000 hits, but at least the first 40 results are all from French sources or medical dictionaries. If you think that the results might be "contaminated" by texts published in countries where English is not the predominant language, you can also refine your results with an advanced search that allows you to select the language and the region associated with the sites. Restricting our search to English lowers the number of hits to 55,000, but again, most of the first 40 results are from French pages or medical dictionaries. Restricting the search to English language and the USA lowers the number of hits to 25,200, and most of the first few pages listed come from medical dictionaries. You can find the English term for *cardiopatías* by looking up the term in the Spanish Wikipedia and then selecting English to see the corresponding article.

Radiation therapy (G: 6,890,000; GS: 1,350,000 results) and radiotherapy (G: 8,300,000; GS: 1,250,000) seem to be equivalent terms for the same technique. Could one be more common in the US and the other more common in the UK? An advanced search restricting the search to web pages in the US yields 10,900,000 results for "radiation therapy" and 10,500,000 for "radiotherapy"; in contrast, an advanced search restricting the search to the UK yields only 324,000 results for "radiation therapy"

but 1,740,000 for “radiotherapy”. Thus, we can conclude that both terms are used in both varieties

of English, but “radiotherapy” is much more common than “radiation therapy” in the UK.

Exercise 37

Use Google to decide which of the following arrangements of words is preferable.

- 1) Appendicitis often presents with _____.
 - a) right iliac fossa pain / pain in the right iliac fossa
 - b) right lower quadrant pain / pain in the right lower quadrant
 - c) lower right quadrant pain / pain in the lower right quadrant
- 2) Most breast cancers develop in the _____.
 - a) exterior superior quadrant
 - b) superior exterior quadrant
 - c) outer upper quadrant
 - d) upper outer quadrant
- 3) Inflammation of the uterus, fallopian tubes, and/or ovaries that leads to scarring with adhesions to nearby organs and structures is called _____.
 - a) inflammatory pelvic disease
 - b) pelvic inflammatory disease
 - c) inflammatory disease of the pelvis
- 4) Which term is most common?
 - a) radioisotope scanning
 - b) radionuclide scanning
 - c) scintigraphy
 - d) gammagraphy
- 5) Which term is more commonly used to describe the condition resulting from the kidneys not filtering waste products from the blood adequately?
 - a) renal insufficiency
 - b) kidney insufficiency
 - c) renal failure
 - d) kidney failure
- 6) Which preposition is used with antibiotic prophylaxis?
- 7) The number one cause of death in the USA is _____.
 - a) heart diseases
 - b) heart disease
 - c) cardiopathies
 - d) cardiopathy
- 8) Is it “invasive ductal carcinoma”, “infiltrative ductal carcinoma” or “infiltrating ductal carcinoma”?
- 9) Which term is more common: “epiploic torsion”, “omental torsion”, or “torsion of the omentum”?
- 10) What is the best order for the following words?
 - a) multicenter prospective cohort study
 - b) case-control observational prospective study
- 11) Which combination of these is best? valve or valvular with insufficiency regurgitation
- 12) Is it “computer tomography”, “computerized tomography”, “computed tomography”, “computer axial tomography”, “computerized axial tomography”, or “computed axial tomography”?
- 13) If you do not use a contrast agent with the above technique, what is it called?
- 14) Is it “one in four”, “one of four”, or “one out of four”?
- 15) Is it “lateral sulcus”, “lateral fissure”, “Sylvian fissure”, “Sylvian sulcus”, or “lateral fissure of Sylvius”?

Punctuation

Punctuation plays a crucial role in communication. Punctuation signs show the structure and organization of the text. They help readers interpret what they are reading and show them where to pause or change their intonation when reading out loud. Although in certain instances writers have a certain degree of flexibility in deciding whether to put in some punctuation marks, in most cases the rules about when and where to place punctuation marks are clear. In other cases, some simple guidelines can help writers use punctuation to facilitate understanding. This section deals only with the punctuation marks commonly used in scientific writing.

Commas

AFTER INTRODUCTORY DEPENDENT CLAUSES

An introductory dependent clause starts with an adverb like *after*, *although*, *as*, *because*, *before*, *if*, *since*, *though*, *until*, *when*, *while*, *whereas*, *etc.* A clause has a subject and predicate, so if it weren't for the introductory adverb, it could stand alone as an independent clause.

- *Because iodine is necessary for the production of thyroid hormone, iodine deficiency can lead to thyroid gland enlargement (goiter).*
- *Though many studies have addressed this issue, differences in the methods used and the populations studied make comparison difficult.*
- *After the antigen is immobilized, the detection antibody is added.*
- *When positive staining is used, the virions are coated with stain and fine details are obscured.*
- *When recombination or reassortment results in a major change in the genome of the influenza virus, a pandemic might occur.*
- *Although antibiotics can kill pathogenic bacteria, they can also kill beneficial bacteria.*
- *If the cell has the appropriate receptor on its surface, the virus enters the cell.*

AFTER INTRODUCTORY PHRASES

Unlike a clause, a phrase does not have a subject and a predicate. There are many types of

introductory phrases. Commas are required after some introductory phrases and are optional after others; however, it is never wrong to place a comma after an introductory phrase.

- Absolute phrases:
 - *After adjustment for age and sex, the variable was no longer significant.*
- Nonessential appositive phrases:
 - *An endemic organism in our environment, *A. baumannii*, represents the greatest threat to our immunocompromised patients.*
 - *A veteran member of our team, Dr. Stein is experimenting with regenerated limbs.*
 - *A condition in which pale green-brown blotches appear on the face, chloasma is related to sex hormones.*
 - *One of the oldest sleeping drugs still in use, chloral hydrate is mainly administered to elderly patients on a short-term basis.*
- Infinitive phrases:
 - *To determine which variables were associated with motor deficit severity, we used chi-square tests for categorical and ANOVA for quantitative variables.*
 - *To compare categorical variables, we used the chi-square test or Fisher's exact test, as appropriate.*
 - *To determine the cutoff point for P-ELISA, we used receiver operating characteristic analysis.*
 - *To rule out contamination by known virus contaminants, extensive in vitro and in vivo assays should be done.*

However, remember that an infinitive phrase can also be used the subject of a sentence.

 - *To discover a cure for cancer is an unrealistic goal.*
- Participle phrases:
 - *Working with rat brains, researchers at the University of Malaga found that the protein RGS-14 boosted the secondary visual cortex.*
 - *Working with rat brains, scientists at the Baylor College of Medicine identified an eight-segment chain of six amino acids that encoded the perception of a particular sound.*

- *Obtained from monoclonal antibodies with significantly reduced immunogenicity, fragments of recombinant antibodies can be used to develop treatments.*
- *Recently developed from traditional ELISA assays, multiplex arrays can measure multiple cytokines in the same sample at the same time.*
- *Specially bred from sterile eggs, the maggots are a safe and effective way to debride gangrenous tissue.*

However, remember that gerund phrases made with the present participle are often used as the subject of a sentence.

- *Working with rat brains can be difficult because they are so small.*
- Prepositional phrases:
 - *At the start of his talk, he told a funny story that helped everyone relax.*
 - *In the 1990s, biotechnology based on gene splicing developed rapidly.*

AFTER INTRODUCTORY WORDS

Introductory words like *furthermore*, *however*, *meanwhile*, *nevertheless*, and *still* can be used to connect two sentences and to show the relation between a sentence and the one that precedes it.

- *Treatment with anthelmintics is usually effective. However, worms can develop resistance to these drugs.*

Note that you can also use a semicolon to join the two ideas into a single sentence, but a comma is still required after the connecting adverb.

- *Treatment with anthelmintics is usually effective; however, worms can develop resistance to these drugs.*

WITH COORDINATING CONJUNCTIONS USED TO MAKE COMPOUND SENTENCES BY JOINING TWO INDEPENDENT CLAUSES

We often place a comma before coordinating conjunctions like *and*, *but*, *or*, *yet*, *for*, *nor*, and *so* when they are used to join two independent clauses. Although the comma can be omitted when the two clauses are brief and nicely balanced, it is never wrong to place a comma before a coordinating conjunction used to join two independent clauses.

- *The major cause of direct lung injury is pneumonia, and the major cause of indirect lung injury is sepsis.*
- *The ethics committee approved the study, and all patients provided written informed consent.*
- *We enrolled 134 patients, but the study was discontinued because of the high rate of adverse events.*

Similarly, a comma is optional but never wrong before *and* or *or* when listing a series of three or more elements. This comma often facilitates correct interpretation.

- *The circulatory system consists of the heart, the arterial network to supply blood to the tissues, and the venous network to return it to the heart.*
- *The nonviable fetus had microcephaly, an enlarged thoracic cavity containing the liver, and talipes equinovarus.*

However, note that coordinating conjunctions used to connect each of the elements in a series are written without commas.

- *The three nucleobases found in the nucleic acids of both DNA and RNA are guanine and adenine and cytosine.*

Commas are also used with *but* to express contrast.

- *He is a brilliant scientist, but a poor communicator.*

Exercise 38

Place commas where necessary in the following sentences; justify your actions with one of the seven rules from the list below. Note that some sentences are correct.

- Rule 1:* Place a comma after an introductory clause, phrase, or word that comes before the main clause. Do not place a comma before these elements when they come after the main clause.
- Rule 2:* Place commas before and after nonessential or free-standing clauses, phrases, and words. If the clause, phrase, or word comes at the end of the sentence, place a comma before it and a period after it.
- Rule 3:* Do not place commas before or after essential clauses, phrases, or words.
- Rule 4:* Place a comma before a coordinating conjunction (*and, but, for, or, nor, so, yet*) that joins two independent clauses.
- Rule 5:* In series of three or more words, phrases, or clauses, place commas between the elements.
- Rule 6:* Place a comma between two coordinate adjectives (coordinate adjectives would sound alright if we inserted *and* between them).
- Rule 7:* Place a comma between elements of geographical names (town or city, state or province, country), between the day and the year in dates, and between names and titles that follow them.

- 1) We presented the preliminary results at the national congress and published the final results in an international journal.
- 2) Serotonin which is derived from tryptophan plays an important role in regulating intestinal movements.
- 3) An antigen is a large complex molecule that triggers a specific immune response against itself when it gains entry to the body.
- 4) Although they are both named after the same man Paget's disease of bone and Paget's disease of the nipple are completely unrelated phenomena.
- 5) The radiologist assured us that the lesion was benign and that it was unlikely to cause problems.
- 6) Some experiments cannot be done because of a lack of funding.
- 7) After the infection was diagnosed and treated the patient recovered quickly.
- 8) Studies that involve changes to the standard treatment regimen must be approved by the institutional review board.
- 9) The cultures revealed Gram-negative Gram-positive and fungal microorganisms.
- 10) The histological analysis revealed undifferentiated stem cells.
- 11) HBx promotes the transcriptional activities of NF- κ B AP-1 and survivin.
- 12) Vitamin D3 plays a role in the induction of host defense peptides in human ocular barrier epithelial cells.
- 13) This conclusion is in my opinion not supported by the results.
- 14) The World Congress will be held in Arlington Virginia USA; the deadline for abstract submission is January 8 2015.
- 15) Because of their refusal to undergo blood transfusions some Jehovah's witnesses refuse to go to the hospital.
- 16) Physicians who have worked in intensive care units are often the ones who are most sensitive to end-of-life ethical issues.
- 17) Fluoroscopy which was once common in general practitioners' offices is now restricted to hospital environments.
- 18) As chief of the department she was responsible for hiring and firing staff members.
- 19) He had an ugly large brown mole on the tip of his nose.
- 20) Dr. Dubner is a paid consultant for GlaxoSmithKline and Dr. Lee has received lecture fees from Novartis.

Exercise 39

Decide whether the following sentences are correctly punctuated with introductory commas. Underline the introductory element and correct any mistakes. Say why each sentence is correct or incorrect.

- 1) When the patient turned around a dozen large welts could be seen on his back.
- 2) Since we got the new scanner, our throughput has nearly doubled.
- 3) Having finished the statistical analysis we started to write the results.
- 4) Usually, we do not administer anesthesia in these cases.
- 5) From the time we started to monitor his heartbeat, we were aware that something unusual was happening.
- 6) When he was in medical school he was only a mediocre student.
- 7) Before you decide which approach to use, you should consider the possible complications involved in each and their importance in that particular patient.
- 8) Nevertheless the secondary analysis found no significant differences.

Exercise 40

Add introductory commas where they are needed in the following sentences.

- 1) To check the goodness of fit of the model we used the Kolmogorov-Smirnov test.
- 2) Since the study was discontinued prematurely our sample size is too small to draw valid statistical inferences.
- 3) Of course we did not start the experiment until the baseline data had been recorded.
- 4) The patient was in critical condition when we started the intervention.
- 5) As I mentioned it may occasionally be necessary to administer a contrast agent.
- 6) Having decided to exclude obese patients *a priori* we had difficulties recruiting enough diabetic patients within our unit.
- 7) To estimate the costs we consulted three independent economists.
- 8) To survive a suicide attempt is not necessarily desirable.
- 9) Conducting a pilot study helped us to design a more robust trial.
- 10) However he tried to extract the fragment he could not.

COMMAS WITH NONESSENTIAL ELEMENTS

An element that can be removed from a sentence without changing its mean is “nonessential”. This doesn’t mean that the element doesn’t add im-

portant information; it provides additional information that does not alter the core meaning of the sentence.

Exercise 41

Identify the nonessential words, phrases, or clauses in the following sentences and add the appropriate punctuation.

- 1) Dr. Patterson who was recently appointed Chief Resident is a born leader.
- 2) Dr. DeLonghi decided nonetheless to observe the procedure.
- 3) Anyone who enters the operating room must scrub up beforehand.
- 4) The grant that I wanted to get is no longer available.
- 5) The first-year resident Sarah Hansen claimed to be an expert in statistics.

- 6) The surgical resident observing the procedure nervously did not say a word.
- 7) The surgical resident that was the most nervous of all did not say a word.
- 8) The research project which many in the hospital considered to be a waste of money eventually increased the institution's funding by over 30%.
- 9) The physical examination sometimes the most informative part of the work-up is often done hastily.
- 10) The hepatic artery which arises from the celiac artery supplies oxygenated blood to the liver, pylorus, duodenum, and pancreas.

Exercise 42

Decide whether the essential and nonessential elements in the following sentences are punctuated correctly. If they are incorrect, correct them. Say why the punctuation is correct or incorrect.

- 1) Our results were as a matter of fact chiefly interesting for what we did not find.
- 2) The nurse who attended the patient said that he had a temperature of 39 °C.
- 3) We did not however intend to repeat the experiment.
- 4) Dr. Harmon having forgotten to close the door was responsible for all the animals escaping.
- 5) Common Gram-positive bacteria, which affect humans, include *Streptococcus*, *Staphylococcus*, *Bacillus*, and *Listeria*.
- 6) The German scientist and physician, Robert Koch, is considered one of the founders of microbiology.
- 7) Paul Ehrlich, who popularized the concept of a "magic bullet", received a Nobel in physiology for his work in immunology.
- 8) Dr. Raul's chief, Dr. Ferrer, is president of the national society.
- 9) The poster about tight junction proteins, that our residents made, won an award at the European congress.
- 10) Our research center which was renovated recently dates from 1956.

Exercise 43

The following sentences have essential and nonessential words, phrases, and clauses in them. Put in the necessary punctuation. Some sentences are already correct.

- 1) Dr. Mariachi wearing a lead apron entered the interventional radiology suite.
- 2) The auricles located inside the atrium are lined with pectinate muscles that form a network of hills and furrows that give it a trabeculated surface.
- 3) The woman who teaches parasitology at the central campus has published a lot.
- 4) The high school course that was most valuable to me was word processing.
- 5) Dr. Harding whose thesis dealt with molecular imaging explained how the PET scanner worked.
- 6) He rewrote his most famous essay "On Science" nine times.
- 7) The cardiology resident who was interested in electrophysiology decided to apply for a fellowship in our hospital.
- 8) Two of my colleagues Mary Beth Edwards and Sean McDowell are planning to study the anti-inflammatory effects of curcumin.
- 9) The graduate student who made the discovery had been investigating a completely unrelated technique.
- 10) Dimitri Medeleev the designer of the periodic table of the elements never won the Nobel Prize.

Connecting two independent clauses

Independent clauses are clauses containing a subject and a predicate, so they can stand alone as simple sentences. Two independent clauses can be connected in four ways:

- 1) by ending the first with a period and starting a new sentence;

The major cause of direct lung injury is pneumonia. The major cause of indirect lung injury is sepsis.

- 2) by placing a comma at the end of the first, adding a conjunction (*and, but, or, or so*) and then continuing the sentence with the second;

The major cause of direct lung injury is pneumonia, and the major cause of indirect lung injury is sepsis.

- 3) by placing a semicolon between the two clauses (this option is usually restricted to

clauses that are closely related and nicely balanced);

The major cause of direct lung injury is pneumonia; the major cause of indirect lung injury is sepsis.

- 4) and by placing a semicolon after the first, adding an adverbial conjunction (*however, nevertheless, thus, therefore, consequently, as a result, on the other hand...*) followed by a comma and then continuing with the second.

The major cause of direct lung injury is pneumonia; on the other hand, the major cause of indirect lung injury is sepsis.

Many words and phrases can be used as adverbial conjunctions, and adverbial conjunctions can have many functions. Some of these are listed in Appendix XI.

Exercise 44

Each of the following sentences needs either a comma or a semicolon. Put in the necessary punctuation.

- 1) Many companies make drug-eluting stents, which are coated with different substances that block cell proliferation these stents are usually placed by interventional cardiologists.
- 2) Dr. Wainwright worked in the emergency room for many years and he now runs a trauma center.
- 3) The operation was a success but the patient, unfortunately, died in the ICU.
- 4) The new scrubs came in a wide variety of colors it was a welcome change.
- 5) As I was leaving the ICU, I heard an alarm for the patient had removed his endotracheal tube.
- 6) The endoscopist preferred to sedate her patients she did not like inflicting discomfort.
- 7) The rats were sedated, intubated, and connected to the monitors everything was ready for the experiment to begin.
- 8) He looked carefully into the microscope but he failed to notice the tiny area of tissue with abnormal cells on the periphery of the specimen.
- 9) The specimen had been fixed but, to his disappointment, nothing else had been done because of the technician's strike.
- 10) The computer could perform millions of operations per second however, it could not think spontaneously.
- 11) I knew the procedure would be tiring but I did not know I would have to be on my feet all night.
- 12) The patient, in delirium, rambled on I was unable to understand what she was trying to say.
- 13) The vascular surgeon repaired the severed artery subsequently, the wound was closed.
- 14) Spanish biologists are supposed to be well trained and I have seen plenty of evidence to support that claim since I have been at this center.
- 15) The first three experiments seemed to indicate that there was no relationship between the two variables however, the last four experiments showed that they were related.

- 16) In the first place, the patient was too ill to transfer in the second place, we did not have the means to treat her at our hospital.
- 17) I have read the article in *Circulation* but I have not read the article in *Stroke*.
- 18) Immunology is my favorite subject in fact, I plan to do a Master's degree in it next year.
- 19) The radiologist made a brilliant diagnosis and the surgeon did not need to perform exploratory laparotomy.
- 20) Large hospitals have everything you need you can find professionals from every specialty under one roof.
- 21) Dr. Ronstadt and Dr. Farell were both in the session this morning they gave an interesting presentation on their research.
- 22) The complications are not serious but they are numerous and annoying.
- 23) Writing lab reports is excellent practice I write several every week.
- 24) I am not interested in going to the European congress this year however, I would like to go to the American congress.
- 25) Not all successful scientists are good communicators but many good communicators are successful scientists.
- 26) Dr. Jackson spent the money on editing her text at least, that was her explanation for the missing funds.
- 27) I have checked the analysis three times but I cannot find the source of error.
- 28) His work may seem irrelevant but you would be surprised to see how many authors cite him.
- 29) She realized that something was wrong she was not however, the only person who was concerned.
- 30) They had to send their responses to the reviewers by Friday otherwise, they would have had to submit the article as a new submission.
- 31) I finished reviewing the article and then I went to bed.
- 32) We always prefer to send our articles to *The Annals* first they have the highest impact factor in our field.
- 33) Dr. Scott went to the pathology department quite often the secretaries even knew her name.
- 34) Most clinicians consider themselves perfectly capable of reading chest X-rays indeed they rarely bother to consult a radiologist at all.
- 35) The lab manager has promised to implement better safety measures and the technicians have agreed to undergo additional training.

Hyphenation

The hyphen is a very useful and necessary punctuation mark. Hyphens serve various purposes. For example, they are used to divide words at the end of a line of text. However, you cannot divide the word wherever you please—you need to divide it between syllables. This seems easy but can be tricky. You can usually avoid doing this, but on rare occasions you might have to, for example, if you are organizing a course and need to elaborate a brochure yourself. Always check a dictionary to confirm syllabification.

Another function of hyphens is to combine two words to make a compound. Compound words can be written three ways: as two separate words, as two words connected by a hyphen, or as an unhyphenated single word. Often there is no consensus about the best way to write a certain compound—sometimes all three ways can be confirmed in different dictionaries! English is rapidly evolving, so the conventions for writing compounds change over time. As a general rule, new compound forms start out be-

ing written as two separate words, then become hyphenated, and finally end up being written as a single word; however, many very common combinations of nouns that have been in the language for a very long time are still written as two separate words. On the other hand, some words that have entered the language only very recently are already consolidated as unhyphenated single words (e.g., *online*, *email*, etc.).

English's amazing ability to combine words to make a semantic unit is usually expressed as two or more words written separately; there are an infinite number of possibilities (e.g., *animal cell culture*, *bile duct obstruction*, *blood cell*, *chest pain*, *compartment syndrome*, *lipid body*, *transmission electron microscope*). However, many compound words in biology and medicine are commonly written as a single, unhyphenated word: *backbone*, *baseline*, *baseplate*, *bedbug*, *bedpan*, *bedside*, *bedsore*, *birthmark*, *blackhead*, *boxplot*, *brainstem*, *brainstorm*, *breastbone*, *catgut*, *chickenpox*, *database*, *doublebind*, *email*, *endplate*, *eyeball*, *eyelash*, *eyelid*, *feedback*, *fingertip*, *flatfeet*, *flatworm*, *foreskin*, *frostbite*, *gallbladder*, *gallstone*, *gunshot wound*, *hangnail*, *headache*, *headquarters*, *healthcare*, *heartburn*, *heatstroke*, *honeycomb*, *hookworm*, *horseradish peroxidase*, *horseshoe kidney*, *hotspot*, *housekeeping gene*, *keyboard*, *keywords*, *kneecap*, *mouthwash*, *network*, *newborn*, *nosebleed*, *pacemaker*, *papillomavirus*, *pathway*, *pokeweed mitogen*, *ringworm*, *roundworm*, *smallpox*, *stomachache*, *sunburn*, *sunstroke*, *tapeworm*, *toenail*, *toothache*, etc.

We do not usually hyphenate nouns made from back formation of phrasal verbs, regardless of whether the verb or particle comes first: *backup*, *backwash*, *breakdown*, *buildup*, *burnout*, *changeover*, *checkup*, *countdown*, *cutback*, *fallback*, *intake*, *outbreak outcome*, *outflow*, *outlet*, *output*, *setback*, *setup*, *spinoff*, *startup*, *throughput*, *turnout*, *uptake*, *upgrade*, *upregulate*, *washout*, etc.

Biomedical terms formed from combinations of root words and prefixes and suffixes that come from the classical languages are normally written as a single word without a hyphen (*anteroposterior*,

etc.), except when the same vowel ends one element and begins the following one (e.g., *salpingo-oophorectomy*). Nevertheless, you do see them written with hyphens. Using hyphens in these words is more common in British English (*antero-posterior*, etc.).

No hyphen is used after most prefixes: *antibody*, *bipolar*, *coenzyme*, *counteract*, *decompress*, *disconnect*, *hyperintense*, *hypoplasia*, *incurable*, *interstitial*, *intracellular*, *malabsorption*, *megabyte*, *microvascular*, *miscarriage*, *noninvasive*, *outpatient*, *overestimate*, *postcoital*, *preprandial*, *pseudoaneurysm*, *quadrilocular*, *recanalize*, *semicircular*, *subchronic*, *superimpose*, *suprasellar*, *transrectal*, *trilobar*, *ultraviolet*, *unenanced*, *underweight*. Note that certain words containing prefixes require a hyphen to distinguish them from other words (*co-op*, *recall*, *re-collect*, *re-form*, *re-cover*, *re-sent*, etc.) Traditionally, when using these prefixes implies doubling a letter, a hyphen was placed between the two elements (*anti-inflammatory*, *intra-abdominal*, *non-nucleated*, etc.); however, it is becoming more common to write these words without a hyphen. Note also that when the prefix is used with a proper noun, a hyphen is required (*anti-Alzheimer drug*, *non-Hodgkin lymphoma*, etc.). A few prefixes are normally written with hyphens: *all-encompassing*, *ex-president* (but be careful—*ex* is not always a prefix; e.g., *expectancy*, *exude*), *quasi-photosynthetic*, *self-limited*. Finally, the prefix *cross* is especially confusing because, depending on the word formed, it may be written as a single, unhyphenated word (*crossover*), with a hyphen (*cross-eyed*), or even as two separate words (*cross education*).

No hyphen is used before most suffixes. To my knowledge, the only exception is *like* when it follows a word ending in double L (e.g., *roll-like*) or when it is attached to an expression made up of two or more words (e.g., *heart attack-like*).

Hyphens are necessary with both prefixes and suffixes when they are used with numbers written as numerals (e.g., *pre-1980*, *10-fold*), but not when they are written as words (e.g., *subzero*, *tenfold*).

The numbers between twenty-one and ninety-nine are hyphenated when written out as words (*eighty-three million, two hundred and forty-three, etc.*). Fractions are hyphenated, except when the numerator or denominator contains a hyphen (*two-thirds, four-fifths*, but *twenty-one one hundredths*).

A few specific compounds are always hyphenated (e.g., *editor-in-chief, father-in-law, half-life, nurse-practitioner, X-rays*).

Eponyms are commonly used in biomedicine to refer to devices, diseases, syndromes, and techniques. When they refer to more than one person, the names are separated by hyphens: *Cheyne-Stokes respiration, Laurence-Moon-Bield syndrome, Prausnitz-Kustner reaction, Swan-Ganz catheter, etc.*

With a few exceptions (see below), two or more words that function as a single adjectival expression are hyphenated when they come before the noun that they modify: *a three-year-old boy, a three-million-dollar grant, androgen-*

binding protein, enzyme-linked immunosorbent assay, follicle-stimulating hormone, the male-to-female ratio, a well-trained lab assistant, etc. However, when these expressions come after the noun, they are not hyphenated: *their son is three years old, the ratio of males to females, our lab assistant is well trained, etc.* Journals have different preferences for hyphenating adjectival expressions containing unhyphenated compounds—some prefer to leave them open (*liver disease-related*) whereas others prefer to hyphenate them (*liver-disease-related*).

We do not use hyphens in comparatives (*a more efficient approach, a better written discussion*), in superlatives (*the most probable explanation, the least expensive method*), in expressions with adverbs ending in -LY (*a highly effective treatment*), in chemical compounds (*adenosine diphosphate conversion*), in Latin expressions (*in vivo anti-infective activity*), or in expressions incorporating a number or letter (*Type II diabetes, stage 3 astrocytoma, grade A agar*).

Exercise 45

Add hyphens to the following sentences where necessary.

- 1) We studied four year old children with atopic dermatitis.
- 2) This experiment requires a little used beaker not found in many laboratories.
- 3) High school age students require different disciplinary approaches.
- 4) Patients with tightly controlled glycemia develop fewer insulin related complications.
- 5) The host's endothelial cells recover the corneal graft, restoring clarity.
- 6) Follow up visits should follow the three step protocol.
- 7) We must follow up the cohort to see whether there are long term changes.
- 8) Acetylcholine induced endothelium dependent relaxation was associated with the endothelium dependent hyperpolarization of the smooth muscle cells in the mesenteric arteries.
- 9) The five hour experiment had to be repeated three times.
- 10) An ad hoc committee was set up to explore ethics related issues in molecular genetics.

Exercise 46

Correct the use of hyphens in the following sentences. Note that some of the sentences are correct.

- 1) They did a four year out-come based study on wound healing and limb salvage in patients with frost-bite.
- 2) The article reported the findings from a randomized, placebo-controlled, clinical trial measuring the effects of high-dose supplementation with vitamins C and E, beta carotene, and zinc on age-related macular degeneration.
- 3) Her back was covered with purplish-red lesions.

Continue

- 4) Figure 3 shows a black and white photograph of the device.
- 5) The placenta is a low resistance path-way in the fetal circulation.
- 6) It was a double blind cross-over study about cell mediated immunity.
- 7) The movement of small ions through cell to cell gap junction channels mediates intercellular signaling at electrical synapses.
- 8) A two-month-old baby presented with a fever and projectile vomiting.
- 9) We studied in-vivo glucose metabolism in type-II diabetic patients.
- 10) We discuss complications resulting from the unintentional intraarterial injection of drugs.

Exercise 47

Put in commas, semicolons, colons, and parentheses wherever they are needed in the following sentences.

- 1) The physicians involved H. Jackson J. Mandarino and S. Freeman are being sued.
- 2) Four viruses can cause Ebola hemorrhagic fever BDBV EBOV SUDV and TAFV.
- 3) Sometimes however microbes normally found in the environment can overcome your defenses regardless of your general health.
- 4) Karen Smythe later to be appointed department head had supported the residents in their fight for better working conditions.
- 5) In last week's NEJM one of my favorite journals there was an interesting article about the dangers of calcium supplements to prevent osteoporosis.
- 6) Patients who were classified as grade I and grade II were followed for 6 months and 12 months respectively.
- 7) The article was published by Nancy Ingram MD and Mary Lou Reina PhD.
- 8) The *in vitro* assay showed that the drug was promising.
- 9) Biological membranes are made of three major components lipids proteins and sugars which are attached to some of the lipids and proteins by covalent bonds.
- 10) However in membranes of the endoplasmic reticulum where phospholipids are synthesized rapid transverse diffusion of particular lipids takes place across the bilayer.
- 11) In general surgery familiarity with a wide range of suturing techniques is useful.
- 12) In general surgery is restricted to patients who do not respond to medical treatment.
- 13) The Diabetic Foot Unit is led by physicians from three specialties podiatry endocrinology and vascular surgery.
- 14) However CT examinations are performed they deliver a large dose of radiation.
- 15) However CT examinations are performed when MRI is contraindicated for example in patients with implanted metallic prostheses or electronic devices or in those with claustrophobia.
- 16) Matrix metalloproteinases MMPs are zinc dependent endopeptidases other family members are adamalysins serralsins and astacins.
- 17) The 1982 Working Formulation introduced the category non Hodgkin lymphoma divided into 16 different diseases however because these different lymphomas have little in common with each other the non Hodgkin label is of limited usefulness.
- 18) However mistakes do occasionally occur for example the Therac-25 radiation therapy machine was responsible for at least six accidents between 1985 and 1987 where patients were given up to one hundred times the intended dose.
- 19) A cyst may contain air fluids or semisolid material a collection of pus is called an abscess not a cyst.

- 20) Myotonic muscular dystrophy type 1 also known as Steinert disease is the most common adult form of muscular dystrophy it results from the expansion of a short repeat in the DNA sequence of the myotonic dystrophy protein kinase gene.
- 21) Because ketamine can cause hallucinations it is not usually used as a primary anesthetic however since it suppresses breathing much less than most other anesthetics it is the anesthetic of choice when reliable ventilation equipment is not available.
- 22) Chemically oxidative stress is associated with increased production of oxidizing species or a significant decrease in the effectiveness of antioxidant defenses such as glutathione.
- 23) The production of nitric oxide is elevated in populations living at high altitudes which helps these people avoid hypoxia by aiding in pulmonary vasculature vasodilation.

Capitalization

In principle, the basic rules for capitalization are simple and straightforward. In practice, however, different interpretations and exceptions can make applying the rules tricky. Although your article will usually be corrected by a copy editor after it is accepted, there is no excuse for ignoring the basic rules for capitalization.

We capitalize the first word of every sentence. Some names and terms begin with a lowercase letter (e.g., mRNA, iPhone, van Horn, etc.); in this case, it is best to rearrange your sentence so that you do not begin with this word. So instead of writing something like A, write something like B.

- A) mRNA-based vaccines are being developed as prophylaxis against infectious diseases.
- B) Vaccines based on mRNA are being developed as prophylaxis against infectious diseases.
- A) iPhones have many potential uses in hospital environments.
- B) There are many potential uses for iPhones in hospital environments. *OR* In hospital environments, iPhones have many potential uses.

We capitalize terms when they refer to proper nouns, in other words, nouns representing unique entities (e.g., *Julia*, *Barcelona*, *Mediterranean*, *Bayer*). We do not capitalize common nouns, in other words, those representing a class of entities (e.g., *person*, *city*, *sea*, *company*) or instances of a class that are not unique. Thus,

we write *the Glasgow Coma Scale*, *the Charlson Comorbidity Index*, *the Minnesota Multiphasic Personality Inventory*, *the West Coast*, *the Board of Directors of Santa Maria Hospital*. However, when the words that make up these specific terms are used in a general way, they are not capitalized, so we write *on a scale of one to ten*, *the blood flow index can be calculated in various ways*, *an inventory of the patient's comorbidities*, *the most inaccessible part of the coast*, and *she attends the hospital board meetings*. Confusingly, a proper noun is often defined as a noun written with a capital letter. Unlike in Spanish, the days of the week and the months of the year are always capitalized in English (e.g., *The opening ceremony will be held on Saturday, August 31, 2013*).

Note that in taxonomic names, which are written in italics, the name of the genus is written with a capital letter and the name of species is written with a lowercase letter. Thus, we write *Staphylococcus aureus*; however, when we use staphylococcus as a common noun, we do not italicize or capitalize the word (e.g., *We isolated six species of staphylococci*).

We also capitalize proper adjectives, in other words, adjectives derived from proper nouns. Like in Spanish, in English we capitalize the names of countries and cities, which are proper nouns. However, unlike in Spanish, we also capitalize adjectives formed from these names, the names of languages, and the names of citizens in these places (e.g., *Spain*, *Spanish*, *Spaniards*, *Sevillian*). When this association becomes remote, the adjective becomes common and is

usually not capitalized (e.g., *caesarian*, *italics*, *roman numerals*, etc.). Another difference is that we capitalize all important words in geographic names (*Lake Michigan*, *the Pacific Ocean*, *the West Coast*, etc.).

Many anatomic structures, diseases, devices, and procedures are named after their discoverers. These eponyms are always capitalized. Note, however, that only the person's name is capitalized—the other words in the term are written in lowercase letters (e.g., *a Swan-Ganz catheter*, *the vein of Galen*, *Doppler ultrasound*, etc.). In what would seem to be a contradiction of the above-mentioned rule regarding proper adjectives, words derived from eponyms are not usually capitalized, although preferences vary among editors. Thus, we usually write *Gram-positive bacteria*, *parkinsonian gait*, and *müllerian ducts*.

We normally use capitals for *appendix*, *figure*, *table*, etc. when designated by a number or letter. *Articles may include up to three tables and three figures. A box and whisper plot for the three experimental groups and the controls is shown in Figure 3.*

When we define an acronym at first abbreviation, we do not capitalize the first letter of the words making up the term unless it is a proper noun. *Candidates for coronary artery bypass*

graft (CABG) must be screened by a heart surgeon. The bacillus of Calmette and Guérin (BCG) vaccine provides protection against tuberculosis.

Some journals also capitalize some words in titles. In this case, adjectives, adverbs, nouns, numbers, pronouns, and verbs are capitalized, whereas articles, conjunctions, and prepositions are not capitalized. The AMA Manual of Style specifies that you should not capitalize “a coordinating conjunction, article, or preposition of three letters or less, except when it is the first or last word in the title or subtitle”, but insists that you should capitalize two-letter verbs like *am*, *be*, *do*, *go*, or *is*. Word processors' grammar correctors often suggest when you have capitalized the wrong words in these cases. One tricky aspect of capitalization for titles is what to do with hyphenated words. The AMA Manual of Style states that you should not capitalize the second part of a hyphenated word if both parts constitute a single word (e.g., *Half-life*, *X-ray*, etc.) or if either part is a prefix or suffix (e.g., *Anti-inflammatory Agents*, *Pre-embolization Planning Studies*, etc.), but that you should capitalize both parts in all other cases (e.g., *Thrombin-Induced Platelet Aggregation in a 12-Year-Old Boy*, etc.). Finally, when titles contain a colon (:), the first word after the colon is always capitalized for books but not for journal articles.

Exercise 48

Choose the answer with the correct use of capital letters to complete the sentence.

- 1) He earned a PhD from...
 - a) ohio state university.
 - b) Ohio state university.
 - c) Ohio state University.
 - d) Ohio State University.
- 2) Her father was the...
 - a) chairman of the anatomy department.
 - b) Chairman of the anatomy department.
 - c) Chairman of the Anatomy department.
 - d) Chairman of the Anatomy Department.
- 3) Duplex ultrasonography combines...
 - a) B-mode imaging to visualize morphology and color doppler imaging to visualize flow.
 - b) B-mode imaging to visualize morphology and color Doppler imaging to visualize flow.

- c) B-mode imaging to visualize morphology and Color Doppler imaging to visualize flow.
d) B-mode Imaging to visualize morphology and Color Doppler Imaging to visualize flow.
- 4) We found several species of...
a) Staphylococci, including *Staphylococcus Aureus*.
b) staphylococci, including *staphylococcus aureus*.
c) staphylococci, including *Staphylococcus Aureus*.
d) staphylococci, including *Staphylococcus aureus*.
- 5) All conference abstracts will be published in...
a) spanish and english.
b) Spanish and english.
c) spanish and English.
d) Spanish and English.
- 6) All patients underwent...
a) magnetic resonance imaging (MRI).
b) Magnetic resonance imaging (MRI).
c) Magnetic Resonance imaging (MRI).
d) Magnetic Resonance Imaging (MRI).
- 7) My daughter was born on...
a) friday, september 30, 2005.
b) Friday, september 30, 2005.
c) friday, September 30, 2005.
d) Friday, September 30, 2005.
- 8) None of the teaching assistants supported...
a) professor wilkins in his bid to become the dean.
b) professor Wilkins in his bid to become the dean.
c) Professor Wilkins in his bid to become the dean.
d) Professor Wilkins in his bid to become the Dean.
- 9) Her career took her from...
a) northern california to southeast asia.
b) northern California to southeast asia.
c) northern California to southeast Asia.
d) Northern California to Southeast Asia.
- 10) The best book I have read this year is...
a) *Genome: The Autobiography Of A Species In 23 Chapters*
b) *Genome: the Autobiography of a Species in 23 Chapters*
c) *Genome: The Autobiography of a Species in 23 Chapters*
d) *Genome: the Autobiography of a Species in 23 chapters*
- 11) The results of...
a) experiment 3 are shown in table 4 and figure 5.
b) Experiment 3 are shown in table 4 and figure 5.
c) experiment 3 are shown in Table 4 and Figure 5.
d) Experiment 3 are shown in in Table 4 and Figure 5.

Continue

- 12) We used a...
 - a) murine model of diabetes mellitus.
 - b) Murine model of Diabetes mellitus.
 - c) Murine Model of Diabetes mellitus.
 - d) Murine Model of Diabetes Mellitus.
- 13) The most common cyanotic heart defect is...
 - a) the tetralogy of fallot.
 - b) the tetralogy of Fallot.
 - c) the Tetralogy of Fallot.
 - d) The Tetralogy of Fallot.
- 14) She wrote a review article entitled...
 - a) "On ANCA-associated Small-vessel Vasculitis among Young Native-american Women".
 - b) "on ANCA-Associated Small-Vessel Vasculitis among Young Native-American Women".
 - c) "On ANCA-Associated Small-Vessel Vasculitis among Young Native-American Women".
 - d) "On ANCA-Associated Small-Vessel Vasculitis Among Young Native-American Women".

Exercise 49

Correct the use of capital letters in these titles where necessary.

- 1) Viral evolution in chronic Hepatitis B: a branched Way to HBeAg Seroconversion and Disease progression?
- 2) Deficiency of Intestinal mucin-2 Ameliorates experimental Alcoholic Liver disease in Mice
- 3) Beclin-2 Functions in Autophagy, Degradation of G-Protein-Coupled Receptors, and Metabolism
- 4) Loss of CARM 1 is Linked to Reduced HuR Function in Replicative Senescence
- 5) Resonance Raman Characterization of the Ammonia-Generated Intermediate of Cytochrome c Oxidase from *Paracoccus Denitrificans*

Apostrophes

Apostrophes have two basic uses in English: to show where letters have been omitted in contractions and to form the Saxon genitive to show possession. As contractions are inappropriate in formal scientific writing, only the second use

concerns us here. We show possession by adding 's to the possessor before the thing that is possessed. The possessor is usually a person or a group of people, although it can also be an animal or less frequently a place.

Situation	Rule	Examples
Single possessor	add 's after the possessor	Teresa's office The mailman's son The dog's heart rate
When a name ends in S	add 's or just an apostrophe	Dr. Ross's experiment Dr. Ross' experiment
Plural possessor (regular)	add an apostrophe after the s that forms the plural possessor	The brain-damaged rats' lungs The residents' calls

Plural possessor (irregular)	add 's after the plural possessor	The children's fear The mice's responses
Plural possessors (proper nouns), object(s) possessed in common	add 's after the last possessor	Watson and Crick's paper Marie and Pierre Curie's discovery
Plural possessors (proper nouns), objects possessed individually	add 's after each possessor	Dr. Smith's and Dr. Jones's conferences Dr. Dubner's and Dr. Rogers's secretaries

Exercise 50

Correct the mistakes in the use of apostrophes in these sentences. Some of the sentences are correct.

- 1) This is a photo of Hector's, where you can see the new microtome.
- 2) This is a photo of Hector.
- 3) This is a malignant tumor—look at it's pattern of radiotracer uptake.
- 4) Lab technicians' are expected to attend the session.
- 5) Dr. Ross' son will be doing a fellowship at Yale.
- 6) Many from the class of '99 have succeeded.
- 7) They work at Johns Hopkins Medical Center.
- 8) The Center's for Disease Control is a founding member of the International Association of Public Health Institute's.
- 9) Is that specimen her's or yours'?
- 10) Senior staff members salaries are competitive with those in the private industry.
- 11) In four month's time, I will have published my first paper.
- 12) Its important to seek the committees approval before starting your experiments.
- 13) Have you read John and Anna's review in *Cell*?
- 14) Julia and Joseph's lab coats need to go to the cleaners.
- 15) The Rockefeller's generous donation covered the building and the lab equipment.

Exercise 51

Correct the punctuation in the following sentences where necessary. Note that some sentences have no mistakes.

- 1) The male to female ratio is about 2:1.
- 2) The experiment, that we discussed last month, was never done.
- 3) However the postdocs English is terrible, so she is unlikely to understand the details of the presentation.
- 4) Department of Thoracic Surgery. Hospital Vall Hebron. Barcelona. Spain.
- 5) The senior resident explained why she hadn't asked for help before?
- 6) In the last five years we have published an average of 7,3 papers per year.
- 7) I can be found in the lab on monday's, wednesday's, and friday's, however, I am never there on tuesday's or thursday's.
- 8) Three fifths of the paramedics, who responded to the survey, had symptoms of burn out in the previous three-years.

Continue

- 9) Cri du chat syndrome is a group of symptoms, which result from a deletion, on the fifth chromosome.
- 10) Influenza can cause severe infections in patients with cystic-fibrosis.
- 11) The twin's father was the primary caretaker.
- 12) All patients underwent Positron Emission Tomography (PET).
- 13) Dr. Salem's secretary's English is excellent.
- 14) Despite Dr. Preston's qualifications, I don't think, he's right for the job.
- 15) The course was held in Miami beach convention center, in Miami, Florida. I could see the atlantic ocean from my room.

Writing numbers

*Not everything that can be counted counts,
and not everything that counts can be counted.*

Albert Einstein

Science as we know it and live it is inconceivable without numbers.

Although the recommendations vary among style guides and journals, these general guidelines can help you express numbers more clearly.

- 1) Spell out one-digit numbers and use numerals for larger numbers. *No differences were found between the **three** groups. All **24** rats in the experimental group died.*
- 2) Spell out numbers at the beginning of a sentence. ***Twenty** healthy volunteers completed the motor tasks while undergoing fMRI.*
- 3) Rearrange sentences to avoid having to spell out large numbers. ***Two hundred and seventy-two consecutive** patients were eligible for the study. **Two hundred and twenty-four** provided written informed consent to participate. ⇒ A total of **272 consecutive** patients were eligible for the study; **224** provided informed written consent to participate. **Six hundred and eighty-eight** events were recorded. ⇒ We recorded **688** events.*
- 4) Use a combination of numerals and words to express very large, general numbers. *The population of Spain is about **47.2 million**. The total direct cost of treating diabetes in the USA was over **\$176 billion** in 2011.*
- 5) Use exponentials to express very large or very small numbers. *Her red blood cell count was **4.3×10^9** per ml. The ionization constant for acetylsalicylic acid is **4.0×10^{-4}** at 25°C.*
- 6) Use numerals before abbreviated units of measurement. *Dissolve all dry reagents together in **800 ml** of double-distilled H₂O. The lipid bilayer is about **5 nm** thick.*
- 7) Use numerals in series in which at least one element is greater than or equal to ten. *The infants' weights were recorded at **1, 2, 3, 6, and 12** months.*
- 8) If two numbers are juxtaposed, spell out one of the numbers. *We analyzed **40 12**-unit samples. ⇒ We analyzed **40 twelve**-unit samples. We analyzed **40** units composed of **12** units each.*
- 9) Punctuate numbers correctly:
 - a) Use commas or spaces to set off thousands, millions, etc. *There are about **23,000** cardiologists in the United States. A total of **134,568** women reside in the screening program's target area.*
 - b) Do not put commas or periods in years. *We included all patients with diabetes diagnosed in **1999**. Recruitment will end on December 31, **2016**.*
 - c) Use periods to mark decimals. *Tumor signal-to-noise ratio was higher for Contrast A than for Contrast B (**364.9 ± 217.8** vs. **253.6 ± 135.8** ; $p = 0.043$).*

- d) Hyphenate adjectival expressions before nouns, prefixes before numerals, and numerals (but not spelled-out numbers) followed by “fold”. A **53-year-old** man presented with **amaurosis fugax**. Physicians’ incomes are approaching **pre-2001** levels. We observed an **11-fold** increase in drug use affecting babies. Hepatotoxicity increased **threefold**.
- e) Hyphenate compound numbers from twenty-one to ninety-nine when spelled out; hyphenate spelled out fractions except when the numerator, denominator, or both are hyphenated. **Two-thirds** of the patients developed some kind of complication. **Five twenty-fourths**... (It is unusual to write out fractions like this. Fractions can be expressed in numerals **5/24** or, when appropriate, as decimals).
- 10) Express ranges differently according to context: use “from... to” or “between... and” or “through” in the body of the text and dashes (—) in tables, parenthetical information, and references. *This concept is illustrated on pages 29 through 32. On Saturdays, the laboratory is open from 9 a.m. to 3 p.m.*
- Between January 1 and December 31, 2012, a total of 645 patients presented with chest pain. 11) Goldacre RJ, Sylven B. On the access of blood-borne dyes to various tumour regions. Br J Cancer. 1962:306-22. We included 75 patients (mean age, 45.3 y; range, 33-54).*
- 11) Express percentages correctly:
- Use the percent sign (%) after numerals. Repeat the percent sign in series and ranges. *The sensitivity, specificity, and diagnostic accuracy were 97%, 85%, and 92%, respectively. The positive predictive values in the 13 studies ranged from 96% to 99%.*
 - Write out “percent” (US English) or “per cent” (UK English) after a number spelled out as a word. *Twelve percent of the patients in the open surgery group died.*
 - Do not separate a percentage from the absolute value it represents. *Complications occurred in 45 of the 60 (75%) of patients treated with open surgery ⇒ Of the 60 patients treated with open surgery, 45 (75%) developed complications.*

Exercise 52

Correct the use of numbers in these sentences.

- 223 ICU chiefs were surveyed; a total of 446 20-minute telephone interviews were conducted.
- Four hundred and sixty-five patients were enrolled in the study. Three hundred and ninety-nine completed the entire 2-month follow-up: thirty patients were lost to follow-up, twenty-nine withdrew from the study prematurely, and seven died.
- In five days, we observed 6 seizures in two male and twenty-two female rabbits.
- 12 patients were excluded because of morbidities.
- 50% of the patients were discharged to home.
- All cultures remained negative for MRSA after 3 days.
- In about three weeks, all dogs had recovered the use of their tails.
- The sensitivity in the twelve studies ranged from 73 to 92%.
- In preparation for the procedure, she was administered 2 antiplatelet drugs, dipyridamole (one hundred mg/day) and acetylsalicylic acid (one hundred mg/day), for 5 days.
- TNF- α upregulated MCP-1 mRNA expression four-fold.

Spelling

The English orthographical system is challenging for both native and nonnative speakers. Unlike in Spanish, where there is nearly a one-to-one correspondence between sounds and their written expression, in English the same sounds can be expressed in writing in many different ways, and the same combination of written letters can be pronounced in many different ways.

Computer spell checkers can catch most—but not all—mistakes in nontechnical words, provided you remember to set the language in your word processor's toolbox. You also need to make sure you select the appropriate variety of English (nearly always UK English or US English—see Appendix XII). You should also create your own

personal dictionaries (one for UK English and one for US English) to which you add the technical words that are common in your fields of interest. It is crucial to check and double-check that the words you add are spelled correctly; otherwise, your computer will misinform you perpetually (or at least until you catch your own mistake).

Although computer spell checkers are becoming more and more sophisticated, they are still mostly limited to catching words that do not exist or words that do not fit grammatically into your sentence according to simple algorithms. On the other hand, they are practically incapable of interpreting spelling based on semantics, so there are occasions when they miss totally inappropriate words of the same grammatical class with spellings similar to your intended word.

Exercise 53

Many English words have similar spellings. Since these are valid words, tools in word processing programs to check spelling are sometimes incapable of detecting these mistakes. Correct the errors in spelling due to similarities with other valid words.

- 1) The prosthesis became lose in the neck of the femur because of bone resorption.
- 2) The day after the party, the nursing supervisor had a sever hangover and a badly bruised ego.
- 3) Fluid is hyperintense on T2-weighed MRI sequences.
- 4) No casual link has been found between antiplatelet agents or anticoagulants and the risk of ICH after CAS.
- 5) It seems that the arrhythmias were caused by scaring from the heart valve replacement three years earlier.
- 6) You should not tell a hyperventilating patient to breath into a paper bag.
- 7) The study aimed to asses the usefulness of vasodilators in patients with heart failure.
- 8) We couldn't find his chart because it was filled under his middle name.
- 9) A multicenter trail is underway to test the safety of the drug in children.
- 10) It is important not to bath until the wound has healed.

Exercise 54

The similarity in the spelling of many words between English and Spanish can also lead to mistakes. Correct the errors in spelling due to Spanish influence.

- 1) Data adquisition before contrast administration is important for image postprocessing.
- 2) Both topic and systemic antibiotics should be administered immediately.
- 3) Patients presenting with biliar colic often require intravenous analgesia.
- 4) Axillary lymph node dissection is important for detecting metastasic breast cancer.
- 5) We will have to consult the neurorradiologist.
- 6) Critical care is not a recognized speciality in some countries.

- 7) There was an outbreak of colera in the refugee camp.
- 8) The patient was referred to an oftalmologist.
- 9) Coartation of the aorta accounts for 5% to 8% of all congenital heart defects.
- 10) Treatment for rabdomyosarcoma consists of chemotherapy, radiation therapy, and sometimes surgery.
- 11) The incidence of hepatocellular carcinoma is higher in cirrotic patients.
- 12) The passage of kidney stones through the uretra can be painful.
- 13) A focal stenosis in the distal urether can be caused by a kidney stone.
- 14) Enteroclisia has been largely supplanted by CT enterography.
- 15) Thiazide diuretics can lead to caliuresis.

Exercise 55

Double consonants are common in English words. Although doubling rules are very useful for knowing when to double consonants before adding suffixes like –ed, –ing, –er, –est, there are a few exceptions to these rules. Doubling a consonant is supposed to show that a vowel is short rather than long; however, this practice is applied very inconsistently. In practice, it is extremely difficult to predict whether a consonant should be doubled in root words of more than one syllable. Some of the following sentences contain errors in spelling—find and correct them.

- 1) The anterior comisure is less than 1/10 the size of the corpus callosum.
- 2) Magnetic ressonance imaging shows excellent contrast among tissues.
- 3) The patient was asymptomatic.
- 4) The tissues are irrigated by the colateral vessels.
- 5) We are comitted to reducing the rate of infectious complications.
- 6) Bleeding occurred in three patients in the treatment group.
- 7) Our anual report contains a summary of our research activity.
- 8) The great Brittish surgeon pioneered antiseptic surgery.
- 9) Early appropriate antibiotic administration is esential in subacute apendicitis.
- 10) The cappilaries are the smallest blood vesels.

Exercise 56

Correct the spelling mistakes in the following text. Mixed spelling mistakes.

Cronh's disease is a type of inflamatory bowell disease. It is a cronic condition that causes diarrhea, abdominal pain, vomitting, and sometimes weigth loss. It is caused by interactions between enviromental, immunological, and bacterial factors in people who are geneticaly susceptible. People with Cronh's disease have cronic reccuring periods of flare-ups and remision. There is no cure for Cronh's disease. Treatment consists of controlling syntoms, maintaining remision, and preventing relapse.

Exercise 57

Identify and eliminate the ambiguity in these sentences.

- 1) Located near the circle of Willis, we saw a bilobed aneurysm.

Continue

- 2) They found a mature teratoma that was in the mediastinum on April 1.

- 3) Situated under the patient's left breast, we could see a bluish-black mole.

- 4) Blocking the splenic flexure, we found a large fecalith.

- 5) Tumors, like carcinoid tumors, start in hormone-producing cells.

- 6) After sending the results, the cultures turned positive.

- 7) Adverse reactions to plasma volume expanders that are extremely uncommon in patients with septic shock probably do not involve IgE antibodies.

- 8) Patients, who take SSRI-type antidepressants, should avoid grapefruit juice.

- 9) However we measured the concentration again and found no signs of error.

- 10) Analyzing the data statistically, terminal repeats were relatively rare.

Simplicity: Avoiding unnecessary complexity

Simplicity is the ultimate sophistication.

Leonardo DaVinci

The problems science tries to solve and the material, methods, and equipment it uses to solve them can be extremely complex, so it comes as no surprise that scientific writers need to use highly complex language to convey their ideas. As science advances along the frontiers of knowledge, new terms must be coined to allow us to deal with new concepts, phenomena, processes, and equipment. Words are often formed by combining pieces of root words from classical languages as prefixes, stems, and suffixes. When we know the roots, the meaning is often readily discernible. Some terms are so long and complicated to say that we nearly always refer to them in abbreviated form, as in deoxyribonucleic acid (DNA), electroencephalography (EEG), temporomandibular joint (TMJ), or tetrachlorodibenzoparadioxin (TCDD or dioxin). Indeed, there is no simpler way to say electrophoresis, fasciotomy, or rhabdomyolysis. Although each of these terms can be explained in relatively simpler terms, it would be absurd to do so every time we wanted to refer to the concept they represent: these terms were coined precisely to enable us to communicate more effectively and more efficiently. This complexity cannot and should not be eliminated from your texts.

However, there is another kind of complexity that hinders rather than helps our efforts to communicate. We often add unnecessary complexity to our texts, stringing together big, “sophisticated” words in long, convoluted sentences when shorter, simpler words arranged in short, straightforward sentences would convey our ideas better. Whether these practices arise from mistaken ideas about what good writing is, from a desire to appear sophisticated or a fear of looking simple, or just from unwillingness to work hard enough to

express our thoughts as clearly as possible, they can make it more difficult for readers to grasp our message (or sometimes even for them to finish our texts).

Throughout the world, students are often rewarded for demonstrating their linguistic prowess through rich vocabulary and grammatical sophistry when learning composition at school. Likewise, programs to teach English as a foreign language are expansive rather than reductive, and many of the same approaches that can enhance your performance in the Cambridge First Certificate and Proficiency examinations can actually compromise the clarity of your scientific writing. Moreover, Spanish is a baroque, flowery language that lends itself to ostentation. In the hands of a talented writer in the appropriate circumstances, this style can be sublime, expressing complex subtleties of transcendent thought. All too often though, style overwhelms content, obfuscating any appreciable message.

People who speak Spanish and other Romance languages as their mother tongue need to be especially careful not to weigh down their message with “sophistication” when writing in English. The Latinate English “equivalents” of words that would be the first or even the only choice in Spanish often sound pretentious to native speakers (e.g., utilize). Moreover, a series of long, complicated sentences with several prepositional phrases and subordinate clauses that might be acceptable in Romance languages can be tedious in English. The effects of unnecessary complexity are cumulative: readers may not be distracted when a writer occasionally uses an unnecessarily complex word or construction, but readers can easily be overwhelmed when a writer consistently adds unnecessary complexity to a text.

This section shows you various ways to eliminate unnecessary complexity from your writing. The two main strategies are using simple words and simple constructions (Fig. 4). Your readers will be grateful to you for eliminating the surrounding noise so they can hear your message loud and clear.

Unnecessarily complex words

Word choice has an important impact on the complexity of the text. Using simple words wherever possible can help make your text reader-friendly. Appendix VI lists some words that might be considered unnecessarily complex or pretentious in many contexts.

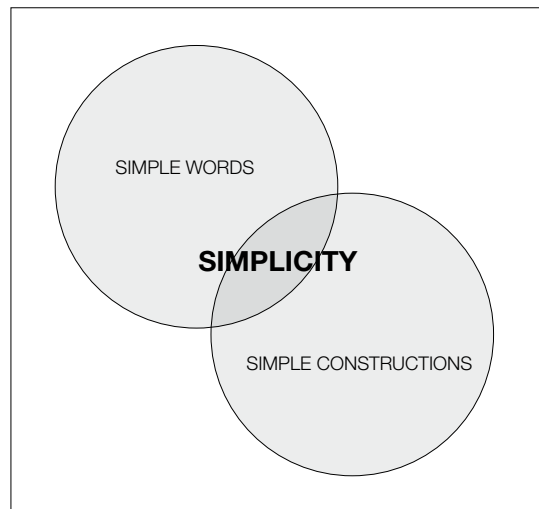


Figure 4. Major aspects related to simplicity.

Exercise 58

Replace the unnecessary complex words and phrases in these sentences with simpler ones.

- 1) Firstly, communities need to take preventative measures.
- 2) We initiated the experiment on Monday morning and finalized it on Thursday evening.
- 3) This manuscript describes a new methodology for genome mining and biosynthesis of polyketides and peptides.
- 4) The majority of experts agree that this problem necessitates the optimization of our methodology.
- 5) Patients with lung cancer frequently have fatal outcome.
- 6) When it is executed befittingly, the technique has efficacious capabilities.
- 7) A catheter was collocated in close proximity to the dilatation.
- 8) Monitorization is indispensable to orientate therapeutic actions.
- 9) The adaptability of the device utilized facilitated the performance of the procedure.
- 10) Familiarization with the most commonly frequently visualized findings will facilitate the implementation of an efficient diagnostic protocol.

Unnecessary nominalization

One way we make writing more complex is to transform a concrete verb into an abstract noun, which requires the use of an “empty”, unspecific verb like *perform*, *carry out*, *be*, or *do*. This practice weakens our writing, diffusing and obscuring

our message. It also lengthens our sentences, wasting valuable words we might need to express other ideas. Appendix VII lists common examples of nominalizations.

Exercise 59

Rearrange these sentences so that the verb carries the message.

- 1) We made the arrangements for the patient to be transferred.

- 2) The pronator teres syndrome should be taken into consideration in patients with pain in the volar surface of the proximal forearm.

- 3) Serine proteases exhibit a tendency to be inhibited in this fashion.

- 4) You must make thorough preparations for the experiment.

- 5) We made a comparison of the two drugs and found no difference in clearance.

- 6) They place a major emphasis on the use of the technique in mechanically ventilated patients.

- 7) We performed the calibration of both thermometers.

- 8) Few authors make reference to aliasing artifacts.

- 9) The authors reach the conclusion that MRI is more cost effective than CT in these patients.

- 10) Immunoglobulin M determinations were performed by nephelometry.

- 11) The measurement of the concentration was made at baseline, 5 minutes after injection, and 2 hours after injection.

- 12) Henri et al. make the assumption that CT is a sufficient imaging method for ruling out pancreatic involvement.

Double negatives

Double-negative expressions add complexity and length to writing, making it harder for readers to grasp your message and wasting words. We sometimes think using a double negative can

add subtle nuances to meaning, but these nuances are nearly always lost on readers. More often we use double negatives to hedge (i.e., to avoid being direct to evade criticism).

Exercise 60

Rewrite these sentences to avoid using a double negative.

- 1) It is not unusual for radiologists to hold two jobs.

- 2) Sex enhances pair bonding through a pathway that involves reward centers in the brain, suggesting the formation of a strong social bond is not unlike an addiction.

- 3) These findings are not without meaningfulness.

- 4) Ignorance is an enduring subject, and it has not gone uninvestigated in sociology.

- 5) We not incorrectly surmised that it might be difficult to enroll enough patients.

- 6) Allergies to iodine are hardly uncommon.

- 7) We were not unencouraged by the results.

- 8) Heather is not unlikely to publish her article in a top quartile journal.

- 9) The authors were not unaware of a possible bias.

- 10) Dr. Sophisticatus' writing is not infrequently incomprehensible.

- 11) The role of MMP levels in inducing instability in carotid plaques is hardly uncontroversial.

- 12) We are not infrequently unable to express ourselves clearly and concisely.

- 13) The reviewers' comments were not entirely uncritical.

- 14) However, the reviewers were hardly impartial.

- 15) To say they would not alter their data to avoid a poor grade in the course is not the least bit unlikely.

The passive voice

In active sentences, the grammatical subject is the agent, the person or thing that acts. Only transitive active sentences (i.e., sentences that have objects) can be transformed into passive sentences.

In passive sentences, the object of the action (the object of the active sentence) is the grammatical subject and the action is expressed by the verb *to be* in the appropriate tense plus the past partici-

ple. The agent can be specified in a “byline” (i.e., a prepositional phrase consisting of by + the agent); however, it is not necessary to specify an agent.

Transitive active sentences have the form: SUBJECT (the agent) + VERB (the action) + DIRECT OBJECT (the person or thing that is acted on):

ACTIVE:

Dr. White intubated the patient.
SUBJECT + VERB + DIRECT OBJECT
(the agent) action (the object of the action)

PASSIVE:

The patient was intubated by Dr. White.
SUBJECT + TO BE + BYLINE
+ PAST PARTICIPLE
(the object of the action) action (the agent — optional)

Although the direct object of the active sentence is usually the subject of the passive sentence, the indirect object of the active sentence can also become the subject of the passive sentence:

ACTIVE:

The Spanish Society gave Sarah an award.
SUBJECT + VERB + INDIRECT OBJECT + DIRECT OBJECT
(the agent) action (the recipient of the object) (the object of the action)

PASSIVE:

Sarah was given an award by the Spanish Society.
SUBJECT + TO BE + OBJECT + BYLINE
+ PAST PARTICIPLE
(the recipient of the object) action (the object of the action) (the agent — optional)

In a few cases, the preposition complement can also become the subject of the passive sentence:

ACTIVE:

Dr. Black operated on my 15-year-old son yesterday.
SUBJECT + VERB + PREPOSITION + OBJECT
(the agent) action (the object of the action)

PASSIVE:

My 15-year-old son was operated on by Dr. Black yesterday.
SUBJECT + TO BE + BYLINE
+ PAST PARTICIPLE
(the object of the action) action (the agent — optional)

The passive voice is often used in scientific writing, although not as much as it used to be. Thirty or forty years ago, science was written almost exclusively in the passive voice. It was thought that removing the subject (the scientist) somehow made the writing more objective. Today, most journals consider the active voice not only

appropriate but even preferable in most cases. The instructions to authors advise using the active whenever natural, even if it means using the pronouns “we” or “I”. The active voice is more direct; the passive voice takes longer for our brains to process. I recommend using the active voice whenever it seems natural.

The passive voice is best reserved for cases in which:

- a) The agent is unknown or unimportant. In these cases, we never include the agent in a byline (*by somebody, by them, by people in general, etc.* or when the agent is obvious).

Her left foot was amputated. We don't care *who* amputated her foot.

Incorrect usage:

Her left foot was amputated by somebody.

(The byline adds no useful information.)

Her left foot was amputated by a surgeon.

(The agent is obvious, so the byline adds no useful information.)

Correct usage:

Her left foot was amputated by a sadistic psychopath. (The agent is NOT obvious, so the byline adds useful information.)

Her left foot was amputated by Dr. Kiraly. (The byline adds useful information; the passive voice shifts the emphasis.)

- b) We want to emphasize the recipient of the action or the action itself rather than the agent.

Dr. Hill was appointed to the expert advisory board.

- c) We do not want to name the agent (often to evade responsibility).

The patient's records were lost or misplaced. A terrible mistake was made.

- d) The noun phrase that specifies the agent contains many modifiers that would require an excessive delay before reaching the verb.

The operation was performed by Foreman and Tierney, two highly specialized surgeons from University Hospital in London.

Finally, the passive voice can make it difficult to keep modifiers close to what they modify. For example:

Three endoscopes were reported stolen by the chief of the digestive disease department. (Did the chief steal them or report them?)

The chief of the digestive disease department reported three endoscopes stolen.

A final word of advice: do not be afraid to use the passive voice judiciously. The passive voice can be useful to help you make transitions and present known information before unknown information (see Familiar-before-new principle, p. 87).

Exercise 61

Change these sentences to the active voice where desirable.

- 1) Casein peptones are made from an insoluble precipitate from acidified milk.

- 2) None of the new approaches was found to be more effective than the standard.

- 3) According to Matthay et al., this restricted, relatively nonrecrutable pulmonary vascular bed with inordinate high pulmonary arterial pressure is considered to be the most likely mechanism of abnormal right ventricular response to exercise.

- 4) Foreman's conclusions are not supported by his findings.

- 5) When respiratory failure seemed likely, the patient was transferred to the ICU.

- 6) Our results are compared with those of previous studies in Table 2.
- 7) Treatment with topical antifungal preparations is usually sufficient.
- 8) Similar experiments were done by Oakes and colleagues.
- 9) The patient's body temperature was monitored by a nurse for two days.
- 10) Appendicitis was confirmed at laparoscopy.

Long sentences

Sometimes we try to cram too many ideas into a sentence, and this results in long, complex sentences that can be difficult for readers to follow.

Keeping sentences short also helps avoid making grammatical or stylistic mistakes.

Exercise 62

Break up these long, complex sentences to make a more intelligible text.

- 1) Certain kinds of mammalian cell lines that express very few endogenous ion channels have been exploited for the heterogeneous expression of ion channels by mixing cells in a tissue culture dish with the cDNA that encodes the ion channel under conditions that permit many of the cells to take up the cDNA, thereby avoiding the need for transcribing messenger RNA, which is fragile and difficult to manipulate in vitro.
- 2) Anemia due to an abnormal increase in the rate of destruction of circulating red blood cells, called hemolytic anemia, can result from the presence of antibodies against the red blood cells, as occurs in hemolytic disease of the newborn, or to autoantibodies or from overactivity of mononuclear phagocytes in association with hypersplenism or from metabolic abnormalities in the red blood cells such as glucose-6-phosphatase deficiency, which is aggravated by some drugs.
- 3) Because hormones that are catecholamines, such as epinephrine and norepinephrine, glycoproteins, and polypeptides are unable to pass through the lipid barrier of the target cell membrane, although some of them can enter the cell through pinocytosis, most of their effects result from their binding to receptor proteins on the outer surface of the target cell membrane.
- 4) Pneumothorax is lung collapse that occurs when air enters the pleural cavity through any breach in the chest wall or in the lung membrane whether resulting from trauma (traumatic pneumothorax), from unknown causes in an apparently healthy individual (spontaneous pneumothorax), or, in the past, from deliberate injection to treat tuberculosis (artificial pneumothorax).
- 5) The common fibular nerve, the smaller of the two terminal branches of the sciatic nerve, arises in the lower third of the thigh and runs downward through the popliteal fossa, closely following the medial border of the biceps muscle and superficially crossing the lateral head of the gastrocnemius muscle as it leaves the fossa to pass behind the head of the fibula and winding laterally around the neck of the bone and pierce the peroneus longus muscle, where it divides into two terminal branches.

Stacked modifiers

English words can be easily combined to make concise units of meanings, helping to keep texts within word limits. However, stringing together

too many modifiers can make it difficult for readers to know what you want to say.

Exercise 63

Expand these noun strings to make their meaning clearer.

- 1) transrectal ultrasound-guided prostate biopsy false-negative prevention protocol
- 2) interventional procedures review evaluation task force
- 3) X-ray beam adjustment calibration manual
- 4) hospital information system access protocol
- 5) a fortified fat-free protein-enriched vitamin C-supplemented pellet-based diet

Exercise 64

Eliminate the unnecessary complexity from these sentences.

- 1) The catalysts utilized are listed in Table 2.

- 2) The analysis that we performed after conducting our investigation offers confirmation that blood glucose levels show a peak within an hour after the administration of the drug.

- 3) The comparison that was made by Jones et al.³ showed that the control rats were not infrequently restless if you take into consideration that their cage was less crowded.

- 4) We were cognizant that we had to take additional measures to assess our methodology.

- 5) This preventative measure was not shown to be ineffective.

- 6) Although he had imbibed a considerable amount of alcohol, when he undertook to ambulate, he proved to have the capability of maintaining his equilibrium.

- 7) The separation of the conjoined twins was done by a surgical team.

- 8) Preparations were made to have the patient transferred to another hospital where more complex assessments could be done.

- 9) From the inception, their methodology of dilatating the stenosis was insufficient to bring about the recanalization of the vessel.

- 10) Not only had we failed to perform the determinations, but we also proved to be incapable of carrying out the calibration of the device.
-

Concision: Making every word count

The most valuable of all talents is that of never using two words when one will do.

Thomas Jefferson

There are many reasons why you should strive to make your writing concise. The most imperative reason is that the authorities require it. Grant applications, congress abstract submissions, and scientific journals all have strict word limits: failure to meet these limits is the first criterion for rejection. The most compelling reason for being concise, however, is that being concise helps us to communicate more efficiently. When we eliminate clutter and noise, we make it easier for our readers to see our arguments and hear our message. Remember that the burden of communication is on the writer's shoulders—we cannot expect our readers to sift through our texts to try to find something worth keeping. Our readers are busy people with projects and lives of their own, and concise writing shows respect for them.

A well-written manuscript should have no unnecessary paragraphs. A well-written paragraph should have no unnecessary sentences. And a well-written sentence should have no unnecessary words. The key word here is unnecessary—when we eliminate unnecessary paragraphs, sentences, and words, we eliminate distractions so readers can focus on what is essential.

Concision is closely related to simplicity, and the two aspects overlap. Many of the practices discussed in the section on simplicity (e.g., avoiding nominalization and the passive voice) will help keep your writing concise. In this section, we will focus on avoiding redundancy (unnecessary repetition), on eliminating empty words and phrases, and on replacing wordy expressions with shorter ones that convey the same meaning.

Avoiding redundancy

There is nothing wrong with repetition. Indeed, it is best to repeat key words and terms throughout your manuscript (see the next section, *Fluidity: Keeping the thread*), and it is a good idea to repeat key parts of your message to make sure that everybody grasps it. Unnecessary repetition, however, clutters your text, diluting your message. Redundancy often affects a single word, but it can also involve a phrase, a sentence, or even a whole paragraph. Redundancies make your writing inefficient, adding useless words to your word count and subtracting from the number of useful words you can use to communicate your ideas. Appendix VIII lists some common expressions that contain a redundant element.

Exercise 65

Eliminate the unnecessary repetitions in these sentences.

- 1) The myth that cell phones cause considerable electromagnetic interference in hospital environments still persists.

- 2) They completely eliminated salt from their diet.

Continue

- 3) We implanted a titanium metallic hip prosthesis.

- 4) The only other alternative choice that is available would be to fuse the three vertebrae together.

- 5) Stevens and colleagues introduced a new technique to extract the enzyme.

- 6) A study is currently underway to determine whether the drug is safe.

- 7) Sphenoid meningiomas can cause visual problems, loss of sensation in the face, or facial numbness.

- 8) Aspirin is absolutely essential in the management of myocardial infarction.

- 9) We detected a malignant carcinoma in his right kidney.

- 10) They used genetic engineering to create a genetically modified transgenic organism that incorporated genetic material from another species.

Eliminating empty words and phrases

Some words and phrases are practically devoid of meaning. Instead of helping your flow of ideas move forward, these words and phrases distract readers from your message and increase word

counts. Revise carefully to detect them and eliminate them from your writing. Appendix IX lists empty phrases that often clutter formal writing.

Exercise 66

Eliminate the empty words and phrases from these sentences.

- 1) She published her doctoral thesis in the year 2011.

- 2) Apart from the presence of local tenderness in the left abdomen, there were no remarkable findings.

- 3) Complications are not uncommon.

- 4) There were serous fluid inside of the pleural space.

- 5) Arthroscopy was performed and the existence of a paralabral cyst was confirmed.

- 6) The abdominal CT showed two large, 6 cm lesions that were round in shape.

- 7) All of the procedures were done under local anesthesia.

- 8) It has long been known that oxidative metabolism occurs in both the cytoplasm and mitochondria inside of the cells.

- 9) We estimated that about one out of ten patients would refuse to participate.

- 10) Comorbidities were greater in number among older patients.

Replacing wordy expressions

Many wordy phrases can be replaced by shorter ones or even by a single word that has the same meaning (see Appendix X). English language education often encourages the use of these expres-

sions and constructions to show proficiency and increase fluency. In scientific writing, though, it is best to be simple and direct. Moreover, shorter alternatives help you to meet word counts.

Exercise 67

Replace the wordy expressions in these sentences with shorter alternatives.

- 1) About three-quarters of patients on sustained low-efficiency dialysis received treatments on a daily basis.

- 2) For the purpose of increasing vasculogenesis, chemokine injection at the site of injury could attract bone-marrow-derived cells.

- 3) Abstract submissions must be received no later than October 12.

- 4) A great number of the experimental animals failed to survive.

- 5) This result would seem to suggest that the left angular gyrus might possibly mediate a spatial representation of number.

Continue

- 6) We determined the hepatitis C virus genotypes in order to define the genotypic profile and examine the relationship between genotype and the prevalence as well as severity of liver disease.

- 7) The presence of this allele has been associated with protective effects against many disease conditions, including but not limited to development of asthma, juvenile arthritis, multiple sclerosis, and liver damage from hepatitis C infection.

- 8) The patient continued to exhibit hypotension in spite of the fact that we administered vasoactive drugs.

- 9) They identified a new murine lectin-like gene in close proximity to CD94.

- 10) Due to the fact that patients in the placebo group were older and sicker than those in the treatment group, the difference in mortality, although significant, may not be meaningful.

- 11) The rate of infections was higher in comparison to the group receiving macrolides.

- 12) There are many germs that can cause pneumonia.

- 13) It is interesting to note that this is not true in the vast majority of cases in the laboratory environment.

- 14) In light of the fact that all of the patients who died had lesions in close proximity to the great vessels, in all probability it is unlikely that...

- 15) We have insufficient knowledge to settle the question as to whether or not this increase in nicotinic receptor levels is accompanied by changes in receptor function.

Exercise 68

Make these sentences more concise.

- 1) There are many conditions that can affect the nervous system.

- 2) It has been well established that cocaine is harmful to your health.

- 3) The study took place in the month of January of the year 2013.

- 4) His gallbladder was full of stones that were brown in color.

- 5) Prof. Thomas, MD, PhD, and colleagues discovered a new, previously unknown species of *Giardia*.

- 6) The belief still persists that all cases of cholecystitis require surgery.

- 7) The end result was two different cells that were exactly identical.

- 8) All traces of the thrombus were completely eliminated from the internal carotid artery after 2 h.

- 9) Lesions that were smaller in size were followed periodically.

- 10) The alternative choice was to deliver the particles with a syringe.

Fluidity: Keeping the thread

Good stories flow... A bad story? One that cannot be absorbed on the first time of reading.

Arthur Christiansen

We must never forget that our ultimate goal is to communicate and that the burden of communication is on the writer. Good writers work hard not only to make sure that their message is clear, but also to make it as easy as possible for readers to follow the thread of their arguments. Well-written texts can be understood on the first reading. Readers should not have to reread any part of a text to be able to understand it, nor should they have to keep referring back to earlier passages to make sense of what they are reading. This section focuses on how to facilitate the reader's task by presenting information and ideas in a logical way (known information before new information and parallel constructions), making smooth transitions, and eliminating obstacles to flow (abuse of abbreviations, inconsistencies in spelling and terminology).

Cohesion and coherence

Cohesion refers to the way the underlying ideas in a text are connected through linking surface elements. In all texts, the interpretation of some words or phrases depends on what comes before them or after them, and good writers make sure this interpretation is clear and obvious. We need to make sure that our ideas are connected so that our readers can follow them. We connect ideas by referring back to preceding text and by using words and phrases (linking devices) that show how the information being presented relates to what was presented before or to what is about to be presented. These linking devices help show the connections between ideas (see Appendix XI). However, these devices are often overused and misused, and linking badly is just as bad as not linking at all.

Other ways to ensure cohesion through a text include repeating key words and using them with determiners (*e.g., this, that, these, those, etc.*), possessive adjectives or pronouns (*e.g., his, her, hers, etc.*), or relative pronouns (*e.g., which, whose, etc.*). Do not be afraid to use identical words in both parts that you want to connect. You can also use synonyms, hyponyms, or hypernyms (*e.g., microbe is a synonym of microorganism, bacteria is a hyponym of microorganism, and microorganism is the hypernym of bacteria*), but be very careful (see *Consistent terminology* below). Another very useful device is to use a grammatical variant of the same word (*e.g., ...the cell becomes hyperpolarized. This hyperpolarization...*). Finally, cohesive nouns provide a kind of lexical reference by summarizing many words in one (*e.g., problem, issue, etc.*) and can be used to refer back to previous text (*e.g., The artifacts discussed above...*) or to indicate what is to come (*e.g., The protocol delineated below...*).

The sentences in the following paragraph link strongly to those that come before and after them; however, something else is wrong.

A Cesarean section is an operation to deliver a baby through an incision in the abdomen. An incision in the abdomen is called a laparotomy. The word laparotomy comes from combining the Greek roots laparo-, which means flank, and -tomy, which means incision. Many medical words come from Greek. Many medical words also come from Latin. Latin gave rise to the Romance languages. Spanish is a Romance language spoken in Spain and the Americas. Other languages are also spoken in the Americas.

What point does this paragraph make? It is impossible to say. Even though it has cohesion,

we cannot know what it is about, because it lacks coherence.

Each paragraph should focus on a specific topic. Each sentence in the paragraph should relate to that specific topic. Likewise, every text should have unifying theme, and each paragraph should be related to that unifying theme.

Just as the connections within paragraphs should help to show how the information added relates to the main point expounded in that particular paragraph, connections between paragraphs should show how the separate ideas that each expresses are related and how they work together to support the main message that unifies your entire text.

In general, the ideas in a new paragraph should fit into the flow of thought from the preceding one, and the new paragraph should start

off where the preceding one finished. In cases where this is impossible or extremely difficult to achieve, you should consider moving the paragraph to another position or eliminating it altogether. Transitions between paragraphs should show the connections between them, so it helps to refer to relevant material from the previous paragraph. Ideally, rather than using a transition that could serve to connect any two paragraphs, you should aim to make specific transitions to connect two specific paragraphs. One way to do this is to use key phrases from the previous paragraph. It is often possible to make these connections with only a few words.

Smooth transitions help your text to flow, making it easier for readers to follow the thread of your argument and to grasp your manuscript as a unified whole.

Exercise 69

Analyze the way these texts are linked.

Look at how these sentences are connected. Note how the underlined text strengthens cohesion.

The pancreas makes insulin and other hormones. These hormones enter the bloodstream and travel throughout the body. They help the body use or store energy from food. For example, insulin helps control blood sugar levels. The pancreas also makes pancreatic juices. These juices contain enzymes that help digest food. The pancreas releases the juices into a system of ducts leading to the common bile duct. The common bile duct empties into the duodenum, the first section of the same intestine.

A. Look at how these sentences are connected. Underline the features that help make the text cohesive.

- 1) The prevalence of type 1 diabetes in the UK is one of Europe's highest. In 2008, the estimated rate was 1.9 per 100,000 children under 18 years of age. Furthermore, strong evidence suggests this prevalence is increasing.
- 2) The UK has the one of the highest prevalences of type 1 diabetes in Europe (1.9/100,000 children < 18 years of age). This rate is at least ten times higher than that of some other European countries. The reason for this large difference is unknown.
- 3) One of Europe's highest prevalences of type 1 diabetes occurs in the UK. Researchers at UK universities and NHS hospitals are at the forefront of research into this disease.
- 4) The UK has one of Europe's highest prevalences of type 1 diabetes. This disabling disease costs the country huge amounts of money.

B. Now choose the best sentence to continue each of the texts. What clues helped you decide?

- a) Not only have they published the four largest series of type 1 diabetes patients to date, they have also made some of the most striking discoveries.
- b) The specific roles of genetics and environmental factors remain to be elucidated.
- c) Not only does the state pay for expensive treatment through the National Health Service, but the government also pays for care for children with diabetes through its Disability Living Allowance programme.
- d) If the trend toward higher prevalence continues, the rate will have nearly doubled by 2020.

Exercise 70

Underline examples of how the authors use transitions to make the text cohesive.

Single-center studies have reported benefits for combination therapy in pneumococcal bacteremia [8], Gram-negative bacteremia [9], infective endocarditis [10], and community-acquired pneumonia [3-7, 11, 12, 13]. Two multicenter studies compared combination therapy with monotherapy in patients with community-acquired pneumonia; both found improved outcome in patients receiving combination therapy. In the first, a randomized clinical trial comparing beta-lactam monotherapy versus beta-lactam plus a fluoroquinolone in 14 hospitals in France, Janice et al. [14] reported shorter hospital and ICU stay and a trend toward improved survival. In the second, a case-control study of 654 patients in 22 hospitals in Spain, López et al. [15] reported that patients receiving combination therapy with a beta-lactam plus a macrolide had shorter hospital and ICU stay, fewer readmissions, and lower in-hospital, 30-day, and 90-day mortality rates than those receiving a beta-lactam alone. Interestingly, in both studies this protective effect was more pronounced in the more severe patients. Although to date no studies comparing fluoroquinolone-based combination therapy with macrolide-based combination therapy have been published, Charles et al. [16] reported a multiple treatment comparison meta-analysis indirectly comparing the two combinations. These authors showed including a macrolide in combination therapy improved survival compared to combination therapy with fluoroquinolones. Thus, combination therapy including macrolides seems recommended in patients with community-acquired pneumonia caused by bacteria.

The rationale for combining antibiotics in patients with community-acquired pneumonia is based on their different mechanisms of action, resulting in synergistic killing and a broader antimicrobial spectrum; however, macrolides are linked to anti-inflammatory effects more than anti-infective properties [3,4,5].

Familiar-before-new principle

Place familiar information before new information. "Familiar information" refers to information that readers would be expected to know either because you have presented it relatively recently in the same text or because it is information that your target audience would be expected to have before coming to your text. The familiar information provides a framework that helps readers see

how each piece of new information fits into what they already know.

This approach also helps us to create cohesion because it allows us to refer back to preceding information to connect ideas. If we reverse this order, placing new information before familiar information, we can make it difficult for readers to see what our text is really about.

Exercise 71

Analyze the order in which information is presented in these texts.

- 1) Compare these two versions of a text about the importance of calcium in the nervous system. The sentences are numbered to help you compare the way the information is presented in each. Which one is easier to follow? Why?

Text A

[1] Calcium channels are particularly interesting because this mineral does much more than simply carry a charge across the membrane.

Text B

[1] Calcium channels in neuronal cell membranes are particularly interesting because calcium does much more than simply carry

Continue

[2] Calcium's role as an intracellular messenger might be even more important than the calcium ions' essential contributions to neuronal electrical activity. [3] Calcium ions that enter the cell regulate several intracellular enzymes after they bind with proteins. [4] Moreover, the gating of several types of ion channel is regulated by intracellular calcium ions, which are even involved in the deactivation of some of their own channels. [5] Finally, intracellular calcium has a tremendous effect on signaling between neurons because it directly controls the release of chemical neurotransmitters at synapses. [6] Thus, calcium plays a key role in the functioning of the nervous system.

a charge across the membrane. [2] Although calcium ions' contributions are essential to neuronal electrical activity, calcium's role as an intracellular messenger might be even more important. [3] Calcium ions that enter the cell bind with proteins and then regulate several intracellular enzymes. [4] Intracellular calcium ions also regulate the gating of several types of ion channel and are even involved in deactivating some of their own channels. [5] Moreover, intracellular calcium directly controls the release of chemical neurotransmitters at synapses, so it has a tremendous effect on signaling between neurons. [6] Thus, calcium plays a key role in the functioning of the nervous system.

- 2) Both the following texts about the development of visual acuity present the same information; however, the order the information is presented in is different. Which do you prefer? Why?

Text A

Visual acuity improves markedly throughout the first six months of life, then more gradually until the child is nearly five years old. At birth, a baby's ability to detect detail (i.e., acuity) is about 20/600, which is thirty times poorer than normal adult acuity (20/20) acuity. This rapid improvement in acuity is due to changes in both the eye and the cerebral cortex.

Text B

Visual acuity is the ability to detect detail. At birth, a baby's acuity (20/600) is about thirty times worse than normal adult acuity (20/20) acuity. But developmental changes in both the eye and the cerebral cortex result in rapid improvement of acuity. During the first six months of life, acuity improves markedly. After that, acuity continues to improve, although more gradually, until the child is nearly five years old.

Exercise 72

Rewrite this paragraph to improve the flow of information.

Malignant tumors of the testicle usually present as a painless lump. About 1 in 250 men develop testicular cancer sometime in their lives, so it is rare. The cause of testicular cancer is unknown. However, a testicle that was not descended during fetal development (cryptorchidism) has an increased risk of developing cancer, and even if it is brought down into the scrotum by surgery early in life, this risk persists. On the other hand, if it has been descended, it is easier to find the lump than if the testicle was left inside the abdomen. It has a high cure rate. Surgery, radiation therapy, or chemotherapy can be used to treat testicular cancer. Most patients survive, even those with metastases to the abdomen.

Parallel constructions

Our minds form expectations as we read. If a page ends "...red, blue, orange, and...", we would be surprised to see "intelligent" or "matrix" at the top of the next page; indeed, anything other than a color will fail to meet our expectations and disrupt the flow of information. Writers need to present information in a structured way that meets readers' expectations. By using similar patterns for presenting words, phrases,

sentences, and even paragraphs that serve similar purposes, we make it easier for readers to process the information. These parallel constructions create symmetry and make your writing more forceful. Failure to use parallel constructions can create confusion and slow readers down.

Look at these examples of parallel and non-parallel constructions in different contexts:

Context	Nonparallel	Parallel
Lists, tables, etc.		
Present information in the same form (i.e., all gerunds, all infinitives, all imperatives, etc.)	a) <i>smoking</i> b) <i>drinking alcohol</i> c) <i>drug abuse</i> d) <i>not exercising</i>	a) <i>smoking</i> b) <i>drinking alcohol</i> c) <i>abusing drugs</i> d) <i>not exercising</i>
Series of elements within a sentence		
Present elements in the same form (i.e., all nouns, all adjectives, all past participles, all gerunds, all infinitives, all relative clauses, etc.)	<i>The specimens were processed as follows: fixation in formaldehyde, then dehydrated, cleared, infiltrated in paraffin, and embedded in paraffin blocks.</i>	<i>The specimens were processed as follows: they were fixed in formaldehyde, dehydrated, cleared, infiltrated in paraffin, and embedded in paraffin blocks.</i>
Place articles either before all elements in the series or only before the first element.	<i>Familial Mediterranean fever mainly affects the Arabs, Armenians, the Jews, Turks, and Cypriots.</i>	<i>Familial Mediterranean fever mainly affects the Arabs, the Armenians, the Jews, the Turks, and the Cypriots.</i> <i>Familial Mediterranean fever mainly affects the Arabs, Armenians, Jews, Turks, and Cypriots.</i>
When the same preposition is appropriate for all the elements, place it either before all items in the series or only before the first element.	<i>This relation has been demonstrated in rats, cats, dogs, and in monkeys.</i>	<i>This relation has been demonstrated in rats, in cats, in dogs, and in monkeys.</i> <i>This relation has been demonstrated in rats, cats, dogs, and monkeys.</i>

Continue

Context	Nonparallel	Parallel
When different dependent prepositions are required, do not omit one. These constructions can seem awkward, so it is often a good idea to seek another solution.	<i>Participating patients must consent and comply with the diet explained above.</i>	<i>Participating patients must consent to and comply with the diet explained above. Participating patients must consent and adhere to the diet explained above.</i>
When more than one verb is used in a sentence, make sure that their objects make sense.	<i>We describe and illustrate the normal findings in the first session, the pathologic findings in the second, and the results of our study in the third.</i>	<i>We describe the normal findings in the first session and the pathologic findings in the second. In the third session, we discuss the results of our study.</i>
Use the same form for elements on both sides of correlative expressions (and; or; both...and; neither...nor; not only...but also; first, second, third...; etc.).	<i>Our institutional review board approved this prospective study, and informed consent was obtained from all patients.</i>	<i>Our institutional review board approved this prospective study, and all patients provided informed consent.</i>
Shift the connector to avoid unnecessary repetition.	<i>This mechanism has been demonstrated both in animal experiments and clinical trials.</i>	<i>This mechanism has been demonstrated both in animal experiments and in clinical trials. This mechanism has been demonstrated in both animal experiments and clinical trials.</i>
Use other similarities apart from form to reinforce connections.	<i>When the amount of neurotransmitter rises, the number of receptors decreases.</i> This sentence is parallel in form; nevertheless, there is a slight semantic imbalance. The sentences in the column to the right are parallel in form and semantically balanced.	<i>When the amount of neurotransmitter rises, the number of receptors falls. When the amount of neurotransmitter goes up, the number of receptors goes down. When the amount of neurotransmitter increases, the number of receptors decreases.</i>

Note: be careful when using of *respectively*. Even when used in parallel constructions, this word interrupts the flow of information by forcing readers to refer back to previous statements before moving on.

Exercise 73

Rewrite these sentences so that the elements are parallel.

- 1) It was both a brilliant article and very concise.

- 2) Ultrasonography is noninvasive, inexpensive, and in nearly all hospitals.

- 3) She wants to learn how to read mammograms, do sonography, and how to perform biopsies.

- 4) First, ensure the patient is conscious; secondly, she must be able to understand you.

- 5) The laboratory findings are listed in Table 2 and the relation between them in Figure 1.

- 6) Not only was the experiment well designed, but also perfectly executed.

- 7) The patient agreed to undergo hemodialysis not a clinical trial.

- 8) Being concise is nearly as important as it is to be clear.

- 9) The device saves time, decreases costs, and patients will be safer.

- 10) The sensitivity in our study was superior and more variable than the other studies.

- 11) In hemochromatosis, iron accumulates in the pancreas, the liver, and heart.

- 12) We told patients that they should drink plenty of water, avoid alcohol, and to sleep eight hours a night.

- 13) The major cause of direct lung injury is pneumonia, and sepsis is the major cause of indirect lung injury.

- 14) Exercising is as important as it is to diet.

- 15) The lab manager has promised to implement better safety measures, and the technicians have agreed to additional training.

Consistent terminology

Sometimes more than one word or phrase is valid to represent a concept; more often, closely related terms refer to closely related but distinct concepts. When more than one term exists for a concept, you need to choose one and use it consistently in all parts of the manuscript (title, abstract, body, tables, figures, etc.). When terms represent closely related concepts, be careful not to use them loosely as if they were synonyms;

if necessary, define them for your readers. Being careful and consistent with terminology can help avoid confusion (some readers might not be familiar with the synonyms) and can help readers process your information more efficiently.

In the artificial exercise below, the misuse of synonyms is easy to appreciate; however, in longer texts, these mistakes might be difficult to spot.

Exercise 74

Correct the inconsistencies in terminology in the following texts.

- 1) Erythrocytes are the most common type of blood cell. Red blood cells (RBCs) deliver oxygen to the body tissues through the circulatory system. These red corpuscles take up oxygen in the lungs and deliver it while squeezing through the capillaries. Unlike other cells, mature red cells have no nucleus.
- 2) The lateral sulcus runs between the frontal lobe and the temporal and parietal lobes. It is one of the most prominent structures in the human brain. The lateral fissure is found in both hemispheres, but it is longer in the left hemisphere in most people. Also called the Sylvian fissure, because its discovery was attributed to the Greek physician Sylvius, the lateral sulcus is one of the earliest developing sulci in the human brain.
- 3) Adrenaline is a naturally occurring hormone produced in the suprarenal glands. The adrenal medulla secretes adrenaline in times of stress. Epinephrine increases the speed and force of the heart beat and thus cardiac output. Adrenalin has been produced synthetically since 1900. The drug epinephrine is sometimes given by injection as an emergency treatment for cardiac arrest.
- 4) Ultrasound scanning is a diagnostic technique in which very high frequency sound waves are passed into the body and the reflected echoes are used to construct a picture of what is inside the body. Unlike some other imaging techniques, ultrasonography uses no ionizing radiation, and it is considered totally noninvasive. For this reason, sonography is the most common imaging technique during pregnancy.
- 5) The hypophysis is a protrusion at the bottom of the hypothalamus. Functionally, it is connected to the hypothalamus by the pituitary stalk. The pituitary gland secretes nine hormones that regulate homeostasis. Diseases of the hypophysis can thus affect the organism in many different ways.

UK vs US English

Oscar Wilde said “The Americans are identical to the British in all respects except, of course, language”. W.B. Yeats said the United Kingdom and the United States “... are two countries separated by a common language”. Although the informal spoken English of the UK and US can sometimes seem like different languages, there are few differences between the two varieties in the formal written language used for scientific writing.

However, it is usually a good idea to use British English for British journals (some admonish prospective authors in the *instructions to authors* not to use American English) and American English for American journals. Nowadays, reviewers are likely to come from all over the world, and the most important thing is not to mix the two varieties. Appendix XII lists the differences that are most likely to affect scientific writing.

Exercise 75

Decide whether these sentences are written in US or UK English. How can you tell?

- 1) Chronic dialysis catheters have a cuff that is tunnelled about 3 cm to 8 cm beneath the skin.
- 2) At least two gene pairs are thought to control human hair color.
- 3) The staff of the Paediatrics Department are holding a talent show to raise funds for playroom.
- 4) We utilised a novel manoeuvre to retrieve the stent graft.
- 5) Dr. Jordan has invented a new breathalyzer to detect certain volatile organic compounds.
- 6) The hematologist diagnosed leukemia.
- 7) Haemolytic anaemia is caused by the abnormal breakdown of red blood cells.
- 8) The urologist, Mr. Chandragupta, and the anaesthetist, Dr. Gray, never speak to one another outside the operating theatre.
- 9) The outpatient clinic is open from 9 a.m. to 5 p.m. Monday through Friday except on holidays. Only emergency patients are attended on weekends.
- 10) After gray-scale ultrasonography, we always do color Doppler imaging because the behavior of the tumor at color Doppler is often indicative of its benign or malignant nature.
- 11) At our centre, we use large calibre needles for core biopsy.
- 12) We used fluoroscopy to visualise the oesophageal course during catheter ablation of atrial fibrillation.
- 13) This paper reports a pilot study using a remote EEG headband that provides a real-time EEG read-out unencumbered by conventional artifacts.
- 14) Studies on the viability of limited bowel catharsis using faecal-labelling techniques have been encouraging.
- 15) We aimed to determine the etiology of diarrhea in travelers to Nepal.

Exercise 76

Correct the mistakes in the use of UK or US English in the following sentences.

- 1) American English: To minimise artefacts due to variations in staining, all samples were processed in parallel.

- 2) British English: The cecum had edema of unknown etiology.

- 3) American English: We report a multicentre study of paediatric anaemia.

- 4) British English: We reviewed the relation between estrogen-binding receptors and the meta-static behavior of breast tumours.

- 5) American English: We use statistical modelling and analysis to characterise genes that influence susceptibility to disease.

- 6) British English: Her doctoral thesis was about leukopoiesis in hematopoietic organs in the fetus.

Continue

- 7) American English: The paediatricians in the group criticised the organisation for the lack of material about childhood diseases in the programme.
- 8) British English: Septicemia can cause hemolytic uremic syndrome, resulting in acute renal failure and sometimes severe hemorrhage.
- 9) American English: She was sceptical about travelling to be treated by a more skilful surgical team.
- 10) British English: Low enrollment led to the cancelation of the trial.

Abbreviations

Abbreviations can help keep your text within the word limits. However, abbreviations can also make your text more difficult to follow. Unless the meaning of the abbreviation is readily apparent to readers, the abbreviation will break the flow of information, requiring readers either to ponder its meaning or to search the text for its definition or even to skip over the term. For this reason, you must be very careful about how you use abbreviations.

In an ideal world, you could always limit your use of abbreviations to those that are better known than the terms they represent (e.g., DNA, RNA, AIDS, etc.). However, be aware that many standard abbreviations have various meanings across fields and even within the same field. For example, PCR can stand for principal components analysis, polymerase chain reaction, protein-creatinine ratio, or prophylactic cranial radiotherapy. In practice, however, it is often convenient to abbreviate.

These common-sense guidelines can help you to use abbreviations well:

- Always check to make sure that there is no standard abbreviation for a term before inventing one yourself.
- Never forget that standard abbreviations can vary across languages.
- If you do invent an abbreviation yourself, make sure it is not offensive for anybody in any way.
- Do not abbreviate single words, unless you have a compelling reason to do so. For example, if you are comparing the imaging techniques computed tomography (CT), magnetic resonance imaging (MRI), and ultrasonography (US), it can be convenient to abbreviate ultrasonography because it is a long word, because it will make your text be parallel in structure, and because US is a standard abbreviation for this technique. The same arguments might also be used for abbreviating tuberculosis as TB.
- Do not abbreviate terms that are used only a very few times. The definition of very few is proportional to the length of the text and to the distance between the definition of the abbreviation and the sentences where it is used. Most journals require you to define all abbreviated terms on first use, but this practice is not very helpful in a long article in which the abbreviation is defined in the introduction and not used again until deep into the discussion. Some journals also require you to provide a list of all abbreviations used anywhere in the text; such a list can be useful, provided readers bother to print it out and keep it handy when reading your article.
- Always be consistent—use the same abbreviations in all parts of the document, including the tables and figures.

- When defining an acronym, do not capitalize words that would otherwise be written in lower case letters: write gamete intrafallopian transfer (GIFT), not Gamete IntraFallopian Transfer (GIFT).
- Be careful not to repeat words that make up part of the abbreviation. For example, do not write MRI imaging, because the I stands for imaging. Do not refer to the Health and Education Research Trial as the HEART trial, because trial is included in the acronym.
- Remember that whether to use the indefinite article *a* or *an* depends on the pronunciation, so in abbreviations that are read letter-by-letter the pronunciation of the name of the letter dictates which to use. We write *a Master of science* but *an MSc*, *a magnetic resonance scanner* but *an MR scanner*.
- Avoid starting a sentence with an abbreviation that begins with a lowercase letter. For example, instead of beginning a sentence “hCG, like other gonadotropins, can be extracted from the urine of pregnant women...”, write “Like other gonadotropins, hGC can be extracted from the urine of pregnant women”.

Exercise 77

Correct the use of abbreviations in the following texts.

- 1) We measured the peak systolic velocity (PSV) in the external carotid artery (ECA) and in the internal carotid artery (ICA). PSV was normal in the ECA artery but elevated in the ICA artery.
- 2) Intratubal transfer (TIT) of gametes and TIT of zygotes are common assisted reproductive technology (ART) techniques.
- 3) All patients who survived (PWS) had severe cognitive deficits.
- 4) An SNP is a DNA-sequence variation in which a single nucleotide differs between members of a species.
- 5) Observations after 12 weeks of treatment were excluded from the ANOVA analysis.
- 6) Adverse Drug Reactions (ADR) were recorded at each center and uploaded to a centralized database.
- 7) Tartrate-resistant acid phosphatase (FART) is an enzyme expressed in bone-resorbing osteoclasts, inflammatory macrophages, and dendritic cells.
- 8) We did an US examination to rule out appendicitis.
- 9) mRNA transport differs between eukaryotes and prokaryotes.
- 10) Telediastolic volume (ESV) is the volume of blood in the ventricle at the end of contraction.

Exercise 78

Rewrite these sentences to make it easier to follow the thread.

- 1) There are several subsets of thymic lymphocytes: the helper T lymphocytes, cytolytic T lymphocytes, and the suppressor T lymphocytes.

- 2) The treatment of anemia depends on its aetiology.

- 3) I agreed I would review your paper not to rewrite it.

Continue

- 4) ICU patients often develop neurocognitive impairments that can be observed years after discharge. These neuropsychological and psychological deficits have an important impact on patients' quality of life.

- 5) Disulfide bonds in keratin fibres confer mechanical rigidity.

- 6) Lipocytes specialize in storing energy as fat. The number of lipocytes can increase once existing fat cells are full, but the number of adipocytes does not decrease after weight loss.

- 7) The animal's behavior showed the anaesthetic was ineffective.

- 8) Carney complex is characterized by superficial angiomyxomas, cardiac myxomas, lentigines, and endocrine hyperactivity. LAMB syndrome shows no racial predilection. Men and women are equally likely to have NAME syndrome.

- 9) Protocols help avoid errors in carrying out tests and reports.

- 10) The large bowel absorbs water from the remaining undigested matter and passes waste material from the body. Colorectal cancer develops in the large intestine, but other diseases also affect the colon.

- 11) Whereas standard EKGs record information from 12 leads, Holter monitors typically have only 2 or 3 ECG channels.

- 12) The residents found the session too detailed, too complex, and thought it could have been shorter.

- 13) Our team is interested and excited about the grant opportunity.

- 14) We studied the effects of estrogen-induced uterine oedema on foetal development.

- 15) Glial cells play a role in dilating arterioles and in their constriction.
